THE RUBBER AGE

ESTABLISHED 1917

COVERS ALL PHASES OF THE PRODUCTION AND MARKETING OF CRUDE RUBBER AND THE MANUFACTURE AND DISTRIBUTION OF RUBBER GOODS

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The History of Rubber as an Engineering Material

By Dr. William C. Geer

UNTIL RECENT years the rubber parts of all rubber articles used in connection with machinery have neither carried sizable loads nor transmitted power. Although uncounted tons of ore, coal, and coke have been transported upon conveyor belts, and although belts and automobile tires transmit power and carry loads, the purpose of their rubber parts is to hold together the strong plies of cotton fabric and to protect them from abrasive wear.

Then, too, the softness of rubber compositions relative to metals and their ability to conform to the irregular surface shapes of structures led to their early and continued use as valve disks and pipe-joint gaskets for water, steam, and air lines. The electrical properties of rubber coupled with its flexibility gave rise to its extended application as wire insulation. Rubber compositions of the correct sort are highly resistant to acids and many other chemicals, hence they can be used as linings for tanks in which chemical processing is accomplished. It is notable, however, that the rubber parts, as differentiated from the metal or fabric parts of all these and many other so-called rubber articles, are relatively thin and carry no load.

In this paper no exposition is undertaken of the physics of rubber in relation to energy absorption or to the design of blocks and shapes for that object. Reference is made to a few pertinent analyses already published. Hirshfeld and Piron *(1)* described rubber with reference to its use as springs for street-cars. Macbeth *(2)* discussed rubber in automobiles with particular attention to wheel suspension. Hahn *(3)* describes a particular type of support for heavy machinery. For data on the physics of rubber one should refer to the excellent chapter by Vogt *(4)* in a recent book.

Therefore, this discussion is limited to some of the high points of the history of rubber compounding with the especial object of showing why it has been possible only within recent years to use rubber as an engineering material, and why today it is possible to manufacture and use rubber successfully in a structure as a component part upon which the essential performance depends. These parts may be of any desired dimensions, either large or small, and are of especial value in supporting vibrating and shock loads because of the inherent peculiar ability of vulcanized rubber to absorb energy.

Note: This paper is scheduled for presentation at the Symposium on Rubber to be held in Providence, R. I., on October 5, in conjunction with the Fall Meeting of the American Society of Mechanical Engineers. It is also appearing in the September issue of *Mechanical Engineering*, official organ of the Society.

From the nature of the case this discussion must center around the chemistry of the rubber mixture, and therefore some of the fundamentals are briefly reviewed.

Rubber is a vegetable product that exists in the form of extremely fine particles dispersed in an aqueous medium in veins of the bark of certain trees which grow in the tropics. When these trees are cut, or according to a well-understood system the bark is tapped scientifically, a thin milky fluid exudes. This is called latex. It runs into cups attached to the tree, is collected, and is taken to a central factory where the rubber content is coagulated by means of a small percentage of acetic acid. After this coagulated product is washed and dried it becomes the solid crude rubber which is the basic ingredient of the vast majority of rubber articles.

During recent years considerable quantities of liquid latex have been shipped from the Far East to this and other manufacturing countries either in its natural concentration of from 36 to 38 per cent total solids, or in one in which the rubber content has been brought up to 60 per cent or more. A new science and art of manufacturing rubber articles directly from liquid latex has developed during the last ten years. We are not concerned with these processes in engineering, because latex, as distinct from solid crude rubber as a raw material, has value primarily in the manufacture of small articles, and those which have high extensibility. This state of the art may not be permanent, however.

Up to the year 1839 the only rubber known was crude rubber, which possessed the unfortunate properties of solidifying to a leather-like product when its temperature fell to freezing, becoming even brittle at below-zero temperatures, and softening to a sticky mass in hot weather. Crude rubber has high plastic flow and a softening point or range but little above that of atmospheric temperature. Naturally these properties restricted the use of this material. Charles Goodyear in 1839 discovered that when a mixture of rubber and sulfur was heated its physical properties were altered. This process was called vulcanization, and that year marks the beginning of the rubber industry. Vulcanized rubber is non-thermoplastic at temperatures well above the highest atmospheric and remains elastic down nearly to—70° C.

However, the Goodyear type of vulcanized rubber compound was an irregular product. Crude rubber varied according to its source, and it was all obtained from forest trees of several species. The time required to vulcanize a mixture of rubber and sulfur alone was long, about two to five hours. Certain substances were known which would increase the rate of vulcanization, but speeds were difficult to control and physical properties could not be exactly reproduced. Different lots or batches of vulcanized rubber were apt to vary due to the difficulty of obtaining the proper cure, or vulcanization. We now know that some of these troubles were due to variability of crude rubber, to the nature of the various ingredients mixed into it, and also to the lack of accurate control of steam used to supply heat. It was natural, therefore, that the majority of rubber articles were those which could be useful when the rubber parts of them were relatively thin in section, when physical tolerances were large, and when rubber was supported by cotton fabric.

During the period 1839 to 1906, coincidental with the demand from industry, there was a steady development in the use of vulcanized rubber for conveyor belts with a surface to resist abrasion, hose to carry water and air, belts for power transmission, gaskets, tires, shoes, surgical goods, wire insulation, and similar articles. The solid tire is about the only one of a long list of rubber products, the dimensions of which were comfortably large, and even these solid tires, cured under the most careful conditions then known, were not identical from surface to center in degree of vulcanization.

Of the several reasons for these irregularities the chief was the type of substance used to speed the combination of sulfur and rubber. It is now common knowledge that this combination is chemical and not simply a physical absorption between these two substances. Certain catalysts or accelerators were well known, of which lead oxide, magnesium oxide, and calcium hydroxide were most usual. It was necessary to use relatively high proportions (from 5 to 20 per cent) of these materials and from 10 to 16⅔ per cent of sulfur to obtain a satisfactory product, which meant in those days a strong, snappy vulcanized product.

During the first ten years of the present century the results of two pioneering efforts became known and available to the rubber industry. The first of these was the development of the rubber plantation in the Far East, which originated with Sir Henry Wickham, who started the enterprise on the island of Ceylon in 1876. As has been stated wild forest trees constituted the whole source of supply of crude rubber. There were many botanical species and many qualities of crude rubber from many countries. Wickham wisely chose his seeds from the one best strain of the species *Hevea brasiliensis* of the upper Amazon River valley. Because of his vision and the efforts of the English and Dutch planters, some 98 per cent of crude rubber now used throughout the world comes from well-regulated plantations where the trees are cared for, and the rubber latex is collected, coagulated, processed, and shipped with adequate scientific supervision. Therefore, even though crude rubber is of vegetable origin and shows some variations, nevertheless a standard, reliable, uniform product, capable of reproduction in any desired tonnage, is available.

Organic Accelerators

The physical irregularities of vulcanized rubber have been conquered by a series of extensive chemical investigations which began in 1906. In that year George Oenslager of Akron, Ohio, discovered that when small quantities of aniline oil, in the order of 1 per cent in terms of rubber, were mixed with the crude rubber and sulfur together with some zinc oxide, the vulcanization took place in much shorter periods of time. Not only that, but smaller proportions of sulfur were required to yield maximum physical properties. What was equally significant in those days, low grades of crude rubber gave much higher tensile-strength values than when vulcanized by aid of litharge. Because this new material was organic in character, the use of the term organic accelerator naturally followed.

Following this discovery and the practical application of it, a large number of researches were undertaken and literally hundreds of organic accelerators were found, each of which possesses its own peculiar effect upon the time and temperature of vulcanization, and also upon the physical properties of the vulcanized rubber mixture.

Of especial pertinence to the use of rubber in thick blocks as an engineering material is the characteristic of certain organic accelerators which when mixed with rubber and not too high a proportion of sulfur, permit vulcanization at a given temperature over long periods of time without overcure. For example,

two compounds *A* and *B* are mixed of the same materials and proportions except that they contain different accelerators. Sheets of each of these are vulcanized in a press at 287° F. for periods ranging from ten to ninety minutes. Test pieces are cut and broken in the testing machine and a curve of tensile strength versus time of cure is obtained for each respective compound.

The curve of compound *A* shows a rapid rise in tensile strength with time, a sharp peak, and a rapid decline. Compound *B* gives a tensile-strength curve that rises and remains at a maximum over nearly the whole ninety minutes. In other words it has a flat curing curve. Each accelerator gives to such a type of compound its own characteristic curing curve. Similar curves can be drawn to show the effect at several temperatures, when the time of cure remains constant.

The development of organic accelerators which give a flat curing curve for a compound has great significance in the field of engineering, because it makes it possible to vulcanize thick masses of rubber without risk of overcuring the outside portions to cure the inside portions properly. In other words, when a temperature is selected which is in harmony with the characteristics of a desirable accelerator then thick masses of rubber can be vulcanized with the certainty of uniform physical properties throughout the product. Because of the low thermal conductivity of rubber and the fact that the vulcanization reaction is exothermic, it is customary, when a large volume is vulcanized, to raise and lower the temperature gradually over a long period of time.

Antioxidants

The older rubber compositions in which only inorganic materials were used possessed not only the irregularities mentioned, but also one further trouble, against which the rubber manufacturer found it necessary to be constantly on the alert. It was not unusual for rubber products to become hard, brittle, and weak after but a few months. This decay is now known to be an oxidation reaction.

About 1918 there began to be used in the rubber industry certain organic compositions which possessed the property of inhibiting the oxidation of vulcanized rubber. Apparently it is not definitely known who was responsible for the first use of these antioxidants. A large number of such substances are in customary use and the problem of rapid aging of vulcanized rubber is conquered. There is only one exception to be made to this statement. It is not yet known how to protect vulcanized rubber from the deteriorating action of sunlight, although a properly mixed composition will remain in good condition in the sun for much longer periods of time than in the earlier days of twenty or more years ago.

From the beginning of the industry dry powders have been used in rubber mixtures to stiffen or to reinforce the product. About 1915, carbon black, a dry soot from the incomplete combustion of natural gas, began its spectacular career as a means for the reinforcement of tire treads against abrasive wear. Since 1920 much research has been undertaken and published (*5*) upon the effect of many reinforcing agents upon the stress-strain properties of vulcanized rubber. These substances are of especial interest to the engineer, because pure gum vulcanized rubber is highly extensible and its deformation under load is great. On the other hand, compositions which contain certain dry powders in some volume, show stress-strain curves which have a small angle with the axis of stress. Thus vulcanized rubber compounds may have a low or high modulus or any desired intermediate value.

Adhesion of Rubber to Metal

So far as the engineering uses of rubber are concerned, one other discovery is significant. Rubber has been attached to metal for many years. Yet up to about fifteen years ago no reliable method of obtaining high values of adhesion between soft vulcanized rubber and metal had been found. There were, to be sure, several schemes in common use. The most usual one, if steel were the metal, consisted of cleaning it, of copper or brass-plating it, laying against the brass a thin sheet of a composition which would vulcanize as hard rubber or ebonite, and building against that the soft rubber desired. Then the whole construction was vulcanized together. The weakness in this system was that hard rubber required, and still does, a long period for vulcanization. It was, therefore, practically impossible to obtain these uniform soft-rubber products attached to a uniform hard rubber. One or the other of these two types of rubber suffered in quality.

In 1923 it was found that certain chemical substances, when mixed with rubber and heated, transformed the rubber hydrocarbon into another hydrocarbon of the same chemical composition, but with a different structure. This changed material is known as a rubber isomer, and it possesses a peculiar property of marked adhesion to clean steel. Since this rubber isomer or "Thermoprene," as it is called, is not vulcanized, it has become possible to attach vulcanized rubber to steel with a high degree of physical adhesion or to vulcanize to it any soft rubber composition that might be desired. However, this method of obtaining adhesion possesses a temperature limit above which the isomer softens. Some of the rubber derivatives seem to show promise of development for their adhesive properties.

The period of rubber history from 1918 to the present time has been one of broadening our knowledge of both the chemistry and physics of vulcanized rubber. A large amount of work has been done in the field of the theories of rubber structure, and there has been much research to discover what rubber vulcanization really is to find out why finely divided powders work as they do, and to study the effects of chemical substances which act as accelerators of vulcanization and inhibitors of oxidation. So today, the state of our knowledge of rubber is of a high order. A rubber composition or compound is subject to exact definition and is reproducible as to properties, whether the mass be small or large. I use this word large somewhat advisedly, because so far as I know, a great mass such as a cube of three or more feet has never been vulcanized simply because no use has ever been found for it.

However, I believe that if you were to call on the rubber industry for a block of vulcanized rubber of the size mentioned, with dimensions and properties from center to surface within reasonable tolerances, the industry would meet such a specification. The period of trial and error in rubber compounding has passed, and for any given purpose within the limitations of vulcanized rubber as a material, uniform products can be obtained.

Limiting Physical Properties of Rubber

The limiting physical properties of rubber are several. Its tensile strength is not high when compared with that of metals, and for individual articles it

must be supported either by cotton, as in the case of tires, or by steel, as in the case of the rubber springs now in use on trolley cars. Its extensibility is large, its elasticity is high, it has abrasive resistance superior to any other known substance, and it absorbs water but little. It is, however, affected by oil, hydrocarbon oils particularly, which it absorbs and by which it is swollen and weakened. Its physical properties do not vary greatly at temperatures within ordinary atmospheric limits, but above and below that range, temperature effects are notable *(6, 7)*. No catalog of the properties or limits of serviceability of vulcanized rubber is advisable here.

The present-day knowledge of rubber is sufficiently exact to lead engineers to have confidence in it as a material wherever its peculiar physical properties warrant its use. I suppose it is natural for the engineer to look upon rubber as something complex and outside his territory. Mention has been made of crude rubber, sulfur, organic accelerators, antioxidants, dry powders, and their effects. It would appear that vulcanized rubber is a complicated structure. I have spoken of the large number of different rubber articles, and it is obvious that the number of rubber compounds which it is possible to make is extensive. Let me remind you, however, that the field of engineering alloys also deals with large numbers of mixtures. One reference *(8)* lists 8206 alloys and gives their compositions and uses. Gillett and Mack *(9)* discuss the various metallic elements entering into this one group of alloy steels alone, and they show, as you well understand, how the proportions of the several metals vary and how small proportions have pronounced effects upon the properties of the resultant alloy.

Quite a complicated subject is the alloy field, at least from the standpoint of the rubber chemist. So, I can see relatively little difference in complexity between alloy steels and vulcanized rubber compositions, except that organic accelerators in their effect upon vulcanization classify themselves somewhat more simply. To be sure, in the field of rubber we have no phase-rule diagrams or photomicrographs to explain the values of carbon black and other ingredients. Rubber is a colloid, and the utility of the organic substances which we use does not depend upon crystal relationships. The fact that rubber requires heat in order to bring it to the desired physical properties means that from the manufacturing standpoint this material is not very different from metallic alloys with which heat-treatment plays such a marked and essential part.

These arguments are introduced merely to show that if the engineer will take an interest in rubber he will find a subject well worth his while. He can gain a sound and constructive understanding of rubber at least as easily as he can of alloys.

Much Research Still To Be Done

Do not let me lead you to believe that the state of knowledge of vulcanized rubber is such that engineers can find data by the application of which large-scale machine-supporting blocks can be designed in the drafting room. Such clearly is not the case. The advances made during the past twenty years have been largely in the chemistry and physical properties of rubber, but application of the product has been confined to relatively small articles. Much research work needs to be done before engineers will be possessed of sufficient data and knowledge of rubber to permit them to design vibration- and shock-absorbing parts for large machines without test by trial and error. The data that we now have are from tests performed upon small pieces, and there is need for research work to permit a translation of small-piece data to terms of large-scale installations.

Such progress as has been made in mounting automobile motors upon rubber blocks, in using rubber springs for automobiles and trolley cars, and in supporting heavy machinery for vibration absorption is of a character pointing rather to the fertility of this field of investigation than indicating a fully developed science.

The time, however, has come when the engineer should take up the study of vulcanized rubber and upon an engineering scale, for until rubber research is graduated from the stage of small test pieces, no great progress can be made. New testing machines must be designed and built. Rubber compositions of several types need study. It does not follow that one type of rubber and one size which may well support a six-cylinder, low-powered motor is the best to support a 500-hp motor in a machine shop. We must know the load-deflection curves for various sizes when rubber is used as a support under compression, under shear, or under extension. Rubber stress-strain curves show extensions of several hundred per cent, yet in engineering service it is probable that small deflections, probably in the order of not over 25 or 50 per cent, will be the limits. Mechanical hysteresis needs careful study both on a small and large scale, and the rate of loading and unloading should be varied over a wide range. All these and other physical properties should be studied on a large scale and the tests performed under a range of temperatures and humidities.

I believe the time has come when regular courses in rubber technology should be given in the engineering schools, to give the engineer up-to-date knowledge of the physics and fundamental chemistry of the vulcanized rubber compound.

The history of alloys, cement, and other structural materials show that the engineer has always been counted on to carry out large-scale investigations and applications. So in rubber the responsibility is upon him in the laboratories of technical schools or industrial plants, to conduct research and make practical use of vulcanized rubber—a highly valuable engineering material.

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Latex Aids Decentralization of American Rubber Industry

Rapid Growth in the Use of Latex is Partly Responsible for the Geographical Expansion of the Rubber Industry

By George D. Kratz

PROBABLY no more pertinent statement concerning the trend of the rubber industry has been made recently than that of S. B. Robertson, President of the B. F. Goodrich Company, to the effect that "whereas tire sales accounted for 68% of the industry's dollar volume in 1927, they accounted for only 58% in 1937." There are certain very definite reasons for this and not the least is the tremendous growth of the use and application of liquid latex.

Although accurate figures are not available, it is safe to state that 25 years ago about 75% of the crude rubber imported for manufacturing companies in the United States found its ultimate destination in two industrial centers—Akron (Ohio) and Trenton (New Jersey). Trenton, although being the home of several substantial tire manufacturers, was and is now better known for its mechanical goods and other staple items of the industry.

Increased Production in New England

The above situation existed without marked change until shortly after the war, except for increased production of rubber goods in the New England states. During 1919 and 1920, a wave of false prosperity swept the country which lent itself to the promotion and formation of an unprecedented number of tire companies, the prospects of which were painted to the investors in most glowing terms. At one time, there was said to be 319 rubber manufacturers producing or about to produce automobile tires. Such companies were spread from coast to coast and almost without exception resulted in a total loss to their shareholders. As evidence thereof, 19 of the remaining tire companies can easily take care of the country's entire requirements for many years to come even if the most extraordinary conditions should develop.

After 1920, the tire industry, generally speaking, returned to Akron and until lately may be said to have expanded and developed to a point inconceivable in the earlier days. In fact, the centralization of the tire industry in the Akron district was so pronounced that in spite of its many advantages of close coordination, it became obvious from both the geographical and labor elements of the situation that a decentralization of the entire industry was inevitable. Again there were definite reasons for the situation created.

An abundance of skilled labor had long been held one of the chief advantages for locating a factory in Akron. Its proximity to the automotive center in Detroit was another. Yet, Akron is, roughly, 450 miles from the Atlantic and 2,500 miles from the Pacific coast and about 1,000 miles from the source of several essential raw materials, such as cotton, clay and carbon black. Naturally, freight charges on raw materials and finished products represent a most substantial figure in the final cost.

The Author

Dr. Kratz, now associated with the Vultex Chemical Co., made his first connection with the rubber industry in 1912 when he joined the Diamond Rubber Co. He has also been associated with the Norwalk Tire and Falls Rubber companies.

From the foregoing remarks, it is not to be assumed that there is any one locality which would better serve as a rubber manufacturing center than Akron. The point to be made, and which has been realized, is that in a country so large as the United States, there is no one point which can serve the country as a whole to best advantage. With such the case, the major companies have manufacturing plants on the Pacific coast, in the south, and in New England. For the most part, they are controlled from Akron but decided economic advantages accrue from this geographical distribution; and what may eventually be more important is that the industry as a whole is removed from a few manufacturing centers and has become the property of, and a means of livelihood for, a vast number of workers in a variety of new industries.

Contribution of the Tire Industry

Peculiarly enough, the tire industry which in the past has dominated the field in this country, has been apparently the most reluctant to accept latex in its processes. On the other hand, by making the entire country rubber-conscious, it has contributed appreciably not only to new developments but has increased the use of rubber for general purposes.

For example, since the earliest days of the tire industry, it has been recognized that it was most desirable to thoroughly impregnate the carcass or cotton fabric element with rubber. To this end, and before latex was available, a wide variety of processes were

devised for impregnating both square woven and cord fabrics with rubber cements many of which are still being used.

The advent of latex appeared to have overcome the difficulties encountered with cements. The substitution of latex solutions for them appeared to be simple, additional wetting properties with greater rubber deposition seemed natural, and the entire operation one which could be readily installed. In actual application, however, it was found that the substitution of an aqueous medium (latex) for rubber cement (organic solvent) did not lend itself to existing equipment. This was particularly evident in the drying operation.

The Commercial Effect of Latex

It was further found that even with the advantages of latex solutions over rubber cement from the standpoint of impregnating the fabric, a thorough saturation could best be accomplished at the source, namely, in the construction of the fabric itself during the spinning or some prior operation. According to recent reports, this has already been accomplished. With such the case, the yarn could be thoroughly impregnated with the desired type of latex solution in the cotton mill and shipped to a nearby tire manufacturer. Insofar as is known, this is not now being done at present on a commercial scale but is decidedly under investigation. In other words, if present indications are correct, the cotton eventually will be impregnated at the source of supply and the point of consumption will be immediately adjacent.

The above illustration is cited simply to bring out the commercial effect of latex and its possibilities to the cotton manufacturer who is not primarily interested in rubber but who realizes the value of the application of a new product to sell his basic material. Cotton is but one of many major industries taking advantage of latex applications to sell its basic commodity. Probably the paper industry was the pioneer in this respect. Even ten years ago, latex-treated papers were on the market in a commercial scale and today a wide variety of paper products containing rubber from latex find their way into the bookbinding and other fields with vastly improved properties.

Opportunity for Small Manufacturers

Even of greater interest than the activities of the major industries wherein each of the larger companies has a highly organized development department, is the general appreciation of the smaller manufacturer of his opportunities. The latter, usually having little or no technical assistance, has been the quickest to grasp that in latex he has a material with which he can work, that is now available ready for use and requires no technical control. Compounded latex, particularly of the pre-vulcanized type, has solved many of the problems of the manufacturers of podiatrist's and dental supplies, novelty jewelers, sculptors, and others never heretofore associated with the rubber industry.

By no stretch of the imagination could New York City be regarded as a rubber center. And yet, today, there is hardly an artist or sculptor of importance in that city who if not using is at least familiar with the uses of compounded latex solutions. What is said in this regard applies equally well to the manufacturers of furs, cravats, road building materials, food containers, flashlights, and a vast variety of other products not ordinarily regarded as potential users of rubber; and the latter statement does not only apply to New York City, but to the country as a whole.

The theatre, as usual, has been one of the first to realize the possibilities of a new medium with which to work. Grotesque latex face masks have been used on Broadway for a considerable period of time. It has taken Hollywood longer than expected to accept the value of this innovation, but it is now evident that what has been done in New York is being magnified in Los Angeles.

Such citations for new uses of rubber, as latex, are admittedly extremes. And yet they express the trend of the times and serve to offer an explanation as to the reason why the tire industry may not and in the future probably will not be the dominating factor in this country.

Latex of the pre-vulcanized type has found such wide use and application in so great a number of fields that in a short period of years, rubber as such will undoubtedly be regarded as a standard medium for use in all industries. Its availability in compounded form and not requiring technical control appeals especially to the small manufacturer; and it is the latter who most often contributes to the general advancement and decentralization of an industry.

Paratex—Special Grade of Silica

A SPECIAL grade of dehydrated micro-amorphous opaline silica prepared from diatomaceous earth is being marketed by the New Hampshire Diatomite Company, Portsmouth, New Hampshire, under the trade name of "Paratex." The new material is designed for use as a filler and reinforcing agent in rubber, asphalt, and similar compositions.

Paratex has a specific gravity of 2.27 and 90% will pass a 325-mesh sieve. The 10% retained on such a sieve is friable and will break down readily during the milling of the rubber compound. It is neutral in tone and can be used in stocks of any color. It does not contain any ingredients that are detrimental to the aging qualities of rubber and does not affect the rate of cure. Its chemical analysis reveals silica, moisture, alumina, iron, lime, magnesia, titanium, alkalies and sulfates. There is only a trace of titanium and sulfates.

A typical tile stock test formula containing 80 volumes of Paratex per 100 volumes of rubber, recommended by the company, consists of the following: Pale Crepe (100.0), Sulfur (2.75), Altax (1.00), Tuads (0.10), Stearic Acid (2.00), Paraffin (1.00), Zinc Oxide (5.00), and Paratex (185.00). Best cure is 20 minutes at 287°F.; specific gravity of the compound is 1.37; shore hardness is 81; and the color is light tan.

One of the outstanding properties that this material imparts to a stock, according to its producer, is great surface hardness. This property is said to be exhibited in loadings as low as 10 volumes per 100 volumes of rubber. Since Paratex is neutral in color, it takes only a small quantity of titanium dioxide to give a good white and white stocks of great hardness can thus be produced.

Were any articles published on the surface treatment of rubber during 1936? The answer to this and similar questions, with all data given as to original sources, will be found in the "Bibliography of Rubber Literature for 1936"—part of the 1937 RUBBER RED BOOK. Paper-bound copies, $2.00; cloth-bound, $3.00.

Determination of Relative Fineness of Zinc Oxides by Surface Wetting

By Dr. Hans-Joachim Mueller
Akron, Ohio

THE accompanying article is based on a method for determining the relative fineness of zinc oxides by surface wetting worked out by the author at the Continental Gummi-Werke in Germany. He reports that pronounced differences are found in Europe between zinc oxides from the same source of supply in summer and winter, a condition which American producers claim does not exist here. The author admits, in a private communication, that "wetting up the zinc oxide is a 'tricky' affair, but those who get used to the method know how to do it." The article is being published for its possible interest to our readers.—(Editor).

THE fineness of raw materials can be determined in various ways, yet most of the methods employed have the disadvantage of being fairly complicated. In addition, the results are often inaccurate. The best known methods for specifying fineness of raw materials are based on sieving the materials through screens of different mesh width. When the residues on the screens are determined, an idea of the fineness of the materials is secured. Fineness can also be determined by the air flotation method. If exact values of particle size are required, then microscopical methods must be used.

The method which shall be described here is based on the determination of the minimum amount of Igepon T solution required to wet a certain amount of zinc oxide.* In order to determine this required amount, the following working procedure is proposed.

One gram of the zinc oxide (the fineness of which has to be determined) is stirred with 1 c.c. Igepon T solution in a mortar with a pestle. Ordinary zinc oxide grades require a 3% solution, coarser grades a 2% solution, and finer grades a 4% solution. The measuring of the Igepon solution should be done by means of a burette calibrated in 1/100ths.

After the zinc oxide is well stirred and wetted, which takes about 15 minutes, the dispersion is poured into a burette, distilled water is added, and the burette is filled to the 100 c.c. mark. The burette is then shaken up and down approximately 10 to 20 times. The lower part of the burette in the range of 4 to 5 c.c. must be such that a reading of 1/10 c.c. is possible.

Waiting for approximately 15 minutes after the thorough shaking of the burette so that the non-dispersed zinc oxide has settled down, the amount of non-wetted zinc oxide is read in 1/10 c.c. on the burette.

If the amount of Igepon T solution is varied for the wetting, different amounts of non-wetted zinc oxide are obtained. Finally the point is reached where all of the zinc oxide is wetted and the amount of wetting agent is directly proportional to the surface of the zinc oxide. Generally speaking, it can be stated that the zinc oxide is somewhat coarser in the summer so that less Igepon T solution is required for wetting. In the winter, it is finer as a consequence of the faster cooling down which results in finer crystals with larger surface, and therefore larger amounts of solution are required to wet it. This was found to hold true for European zinc oxides during the course of several years. American zinc oxides have not yet been tested by this method, insofar as the author is aware.

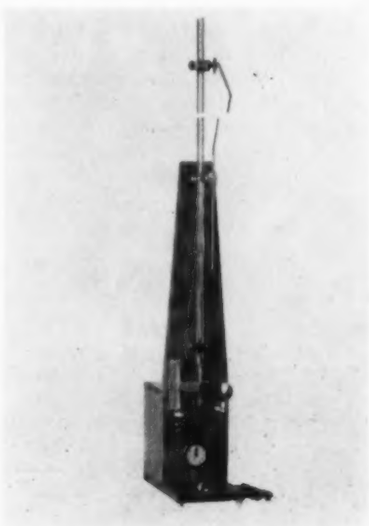
When the amounts of Igepon T solution in 1/100 c.c. are plotted on the ordinate, and the amounts of non-wetted zinc oxide in 1/10 c.c. are plotted on the abscissa, a straight line results when the different points are connected. In this way it is possible, after having determined two or three points of this straight line, to find the minimum amount of Igepon T solution necessary to wet a given amount of zinc oxide.

As this minimum amount of Igepon solution is a characteristic for the active surface of the zinc oxide, a simple method is given by this means to control the uniformity of zinc oxide shipments on one hand and the fineness of the zinc oxide on the other.

(*) Igepon wetting agents are products of the General Dyestuff Corporation, New York City.

ADDENDA

Since receipt of the above article, we have published a description of a device called a "particle sizer" which is based fundamentally on the principle described above



Palo-Travis

Particle Sizer

by Dr. Mueller. (See p. 300, August, 1938, issue of THE RUBBER AGE). Briefly, this apparatus (illustrated herewith) consists of a mixing chamber separated from a large tube by a stop cock. A sedimentation measuring tube is supported at the base of the large tube. This measuring tube is graduated in millimeters with a micrometer eye-piece attached for determining sediment heights in fractions of a millimeter. A small electric tapper serves to level the settled material and an illuminating unit is provided to simplify readings. The sample of material is placed in the mixing chamber from which it passes into the glass tube filled with water or wetting agent. After tapping and settling, the height of the sediment in the measuring tube is read at regular intervals, from which the size of the particles can be calculated. (EDITOR).

German Rubber Industry in 1937

REGULATIONS governing rubber consumption in Germany during 1937 were considerably intensified, according to a report from the Office of the American Commercial Attache, at Berlin, to the Bureau of Foreign and Domestic Commerce. The Supervisory Board for Rubber Production set monthly raw material quotas for each manufacturer, usually in proportion to 1936. At the beginning of 1938, restrictions were placed on factory extensions, and production of reclaimed rubber and goods from reclaimed rubber was subjected to special permit. Firms using over 500 kilos of rubber monthly, or holding stocks of 500 kilos or more, have to keep books showing stocks, buying and selling prices, and names of buyers and sellers.

The domestic price of rubber has been stabilized, through the fluctuating import duty on rubber, at around 260 reichsmarks per 100 kilos. The proceeds of the duty for the 10 months during which it was in effect was between 85 and 90 million reichsmarks. Artificial rubber is not included in the German tariff schedule, but manufactures from it are dutiable on the same basis as those of natural rubber. The higher rubber prices have been borne by consumers, though dealers' profits have been reduced from 17 to 20 per cent. The price rise was most noticeable in tires which account for about 60 per cent of German rubber consumption; articles containing small amounts of rubber were little affected.

Imports and Exports Increased

Imports of rubber manufactures amounted to 22,456 metric tons in 1937 against 20,836 in 1936, the increase being due entirely to larger imports of scrap rubber. Exports of rubber manufactures increased to 18,909 metric tons against 16,429 in 1936. Imports of rubber, gutta percha, and balata combined amounted to 123,193 metric tons against 82,666 in 1936. The United States participated in supplying a greatly increased amount of scrap rubber to Germany in 1937 for reclaiming purposes.

The Buna plant at Schkopau is expected to reach capacity this year. The price of Buna has been brought down to between 4 and 5 RM per kilo and total 1938 production is estimated at 25,000 tons. (This estimate seems high since the Schkopau plant has a capacity of 25,000 tons and will not be at capacity the entire year, while 1937 production was perhaps not more than 3,000 or 4,000 tons.) While efforts of authorities will be to keep natural rubber imports low, the arrivals for six months of 1938 at 47,600 long tons exceed the corresponding 1937 figure of 44,500 tons.

Function of Fillers in Compounding

IN the compounding of rubber there are many ingredients which have some effect on the physical properties of the compound containing them while others may be regarded purely as diluents. Nevertheless, there is no definite line of demarcation between the two classes of materials and they are conveniently considered together. In many cases it is only possible to decide very broadly into which subdivision—reinforcing or diluent—an ingredient belongs. An attempt to place fillers in their proper categories is made by T. L. Garner in an article on "The Function of Fillers in Rubber Compounding" in a recent issue of *Chemical Age (London)*.

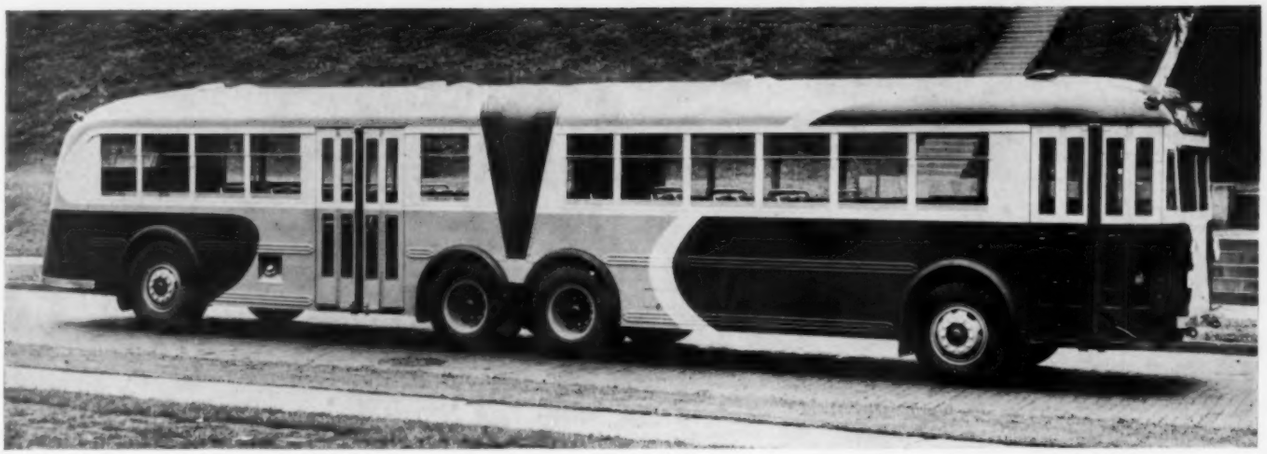
Variation in the properties of one particular material is often so marked, according to the particle size, as to make it impossible to place it in one class or another, says Mr. Garner, but this is certainly not the case with carbon black, the most important reinforcing filler. Zinc oxide can also be classed as a reinforcing agent, but a very important ingredient, china clay, varies so widely in its characteristics that while the best grades are important in their reinforcing properties, the poor grades are little, if in any way, superior to a first-class whiting which definitely falls into the diluent class.

The importance of fine particle size in a given ingredient is often, therefore, very great and it is particularly desirable in reinforcing agents in order to secure maximum effect. Because a compound has a small particle size, however, it cannot be stated in consequence that it will be a reinforcing agent, and a typical instance is the ingredient lithopone, which has a smaller particle size than zinc oxide, but has a negligible reinforcing action.

Reinforcing action depends upon the intensity of the bond between the filler particle and the rubber itself, the specific material, the nature of its surface, and the degree of dispersion in the mixing all being influencing factors. Reinforcing agents have already been classed as those compounds which formed a bond with rubber stronger than the matrix and diluents as those compounds which formed a bond weaker than the matrix. In the ideal state of dispersion in rubber, the author points out, each particle of the filler would be isolated by a rubber film from one another, and the extent to which this is possible is determined by the degree of wetting of the filler by the rubber, or the force of adhesion between the two.

In the case of a poorly wetted material, flocculation may occur when the rubber is in a more fluid condition, as during the early part of the vulcanization process. Flocculated material gives hardness to the rubber, but the dispersed compound is responsible for improvement in abrasion resistance and tear. Improved dispersion can be attained by the use of suitable dispersing agents, such as for example stearic acid, and these are widely made use of, particularly in the case of carbon black and tire tread mixtures.

Mr. Garner discusses a number of reinforcing and diluent fillers in his article. Magnesium carbonate, he states, possesses no covering power in rubber despite its whiteness. Glue he classifies as a reinforcing agent since it stiffens rubber and increases the resistance to abrasive wear. With respect to this material, however, he says that difficulty in obtaining consistent quality over a period has prevented its wide use, but for low gravity, tough stocks it is still in fair demand. The author also describes the various types of diluent fillers, including whiting, kieselguhr, barytes, French chalk, etc.



The flexible rubber diaphragm, which stretches up to 35% when necessary, is clearly seen in this view of the Super-Twin Coach.

New Trackless Street Car

Super-Twin Coach, Capable of Carrying 120 Passengers, Utilizes a Flexible Rubber Hood in Its Construction

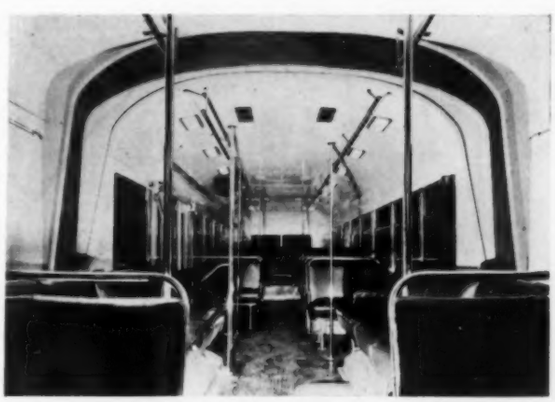
ALTHOUGH there are approximately 30,000 motor buses and trolley buses in use on urban operating systems, a complete transition to rubber-tired vehicles has been held back by the lack of a tired unit capable of carrying as many passengers as a large trolley car. The major difficulty in this respect was the inability to produce a trackless vehicle of a size capable of carrying so large a number of passengers and still be able to make the necessary street intersection turns. The answer to this problem, one which may revolutionize bus transportation, is believed found in the new Super-Twin Coach recently introduced by the Twin Coach Company of Kent, Ohio. It should be a satisfaction to the rubber industry that rubber plays an important role in the construction of this new unit.

The Super-Twin Coach is the largest capacity single deck passenger vehicle for public carrier service, without the use of tracks, to make its appearance. It weighs 27,500 pounds, seats 58 passengers on a single deck, and will transport a peak passenger load of 120, including standees. It is designed to operate as an electric trolley or by Diesel-electric propulsion, and is capable of a top speed of 50 m.p.h., which means it should have no difficulty in maintaining an average schedule speed of 13 to 14 m.p.h. in regular traffic schedule.

This new carrier has four axles and eight wheels and bears its load on twelve tires, the four center wheels taking dual tires. Steering is arranged by means of the synchronous action of the front and rear wheels. The four wheels in the center pivot on the same principle adapted to the many six-wheel vehicles already in use. Because of its 47 foot length (the length varying with requirements) the body is hinged perpendicularly at the center, and the space covered by a newly developed flexible rubber hood, the perpendicular articulation allowing it to take with ease bridge, viaduct and other sharp grades oftentimes found within the confines of metropolitan areas.

The flexible rubber hood or diaphragm, designed by Goodrich engineers, stretches up to 35% under extreme conditions. It is of a patented construction, special sun resisting rubber being vulcanized to cotton cords, similar to the structure of a tire. The cords are laid at such an angle with the vertical that as the diaphragm stretches the cords change angle like a hinge, permitting the structure to stretch and still maintain a taut appearance. If the diaphragm were all rubber, Goodrich engineers point out, there would be constant danger of slitting, especially if someone should stick a knife or other sharp-pointed instrument in it, but the cords prevent such ripping. It will be recalled that Goodrich has designed rubber diaphragms of similar construction for use on many of the new articulated streamlined trains.

The application of this flexible rubber hood permits the Super-Twin Coach to turn on a radius no greater than that required by most of the 35-passenger gasoline coaches already in wide service in this country. The hinged section of the articulated joint is equipped with compressed rubber, which together with



An interior view of the new Super-Twin Coach in which rubber-cushioned seats are featured.

the flexible rubber hood obviates the necessity of lubricating any part of the hinged section. There is no horizontal hinging of any type, and the width of the vehicle may be made to equal that of the large-capacity trolley cars. The floor has no obstruction of any kind, presenting a smooth, flat surface.

As can be readily understood, the Super-Twin Coach is built up in two sections, each section following the manufacturer's light-weight, all-metal, structural design. The two units are joined at the center by a high-strength alloy steel tube mounted to large heavy malleable castings attached to each section. Preloaded rubber bushings are mounted to the tube so that individual unit movement is noiselessly absorbed. The center springs are mounted to another steel tube located directly below the hinge tube.

Rubber Used in Other Applications

Rubber is liberally used in many other parts of the new passenger bus. There are molded rubber fenders, eight in all. Rubber splash shields are used at the wheelhousing. The propulsion engine, generator and electrical motors are mounted to the under frame on rubber. The first and second steps of the center exit door are equipped with rubber treads, while the front entrance and center exit doors are equipped with rubber at the closing edges to prevent accidents.

All of the seats in the Super-Twin Coach are equipped with rubber cushions. The control rods extending from the driver's compartment to the rear of the vehicle operate on guides impregnated with rubber. Vertical stanchions are of the floating type, one end operating in a rubber bushing-equipped sleeve. All side window glass, the front windshields, and the front destination sign glass are sealed against moisture by means of channel rubber. A special piece of molded rubber is installed between the front and rear floor at the center section of the bus where movement occurs.

In addition to these applications, there are miscellaneous parts of the coach where sealing is required, and invariably rubber was used to obtain the seal, according to Ross Schram, sales and advertising manager of the Twin Coach Company, who supplied the above information.

Control of the Super-Twin Coach

Control of the new vehicle by the operator is exactly the same as on a conventional motor coach or trolley coach. The steering of the front and rear wheels is accomplished through linkage and the use of air which automatically supplements the manual effort on the driver's wheel. The rear wheels follow the tracks of those in front. A number of these new coaches are now being tested in actual service. At this writing it is being tested as a substitute for street cars in Akron.

An idea as to the significance of the Super-Twin Coach to passenger transportation may be realized from some of the following economic facts supplied by Mr. Schram: (1) Modern trolley car road bed and track cost is $100,000 for double tracks; buses require no tracks. (2) Large-capacity rubber-tired "street cars" are not tied to a strip in the center of the street, thus reducing traffic hazards to a minimum. (3) Diesel-electric power can be furnished at less cost than gasoline power. (4) Trolley car road-way maintenance, estimated at 3½ cents per mile per year, is eliminated.

Giant Piece of Rubber Molded

WHAT is believed to be the largest single piece of rubber ever molded has been produced at the Torrance, California, factory of the Rubbercraft Corporation of California, under the supervision of Charles N. Merralls, president. Known in the oil fields as a "blow-out preventer", the giant piece was made

Rubber "Blow-Out Preventers"

for the Regan Forge & Engineering Company of San Pedro, California. The "blow-out preventer" is cylindrical in shape, and is 30 inches high and 30 inches in diameter.

Due to the service these products are called upon to perform when in the oil fields, a series of special oil-resistant, anti-abrasive and flexing compounds were developed. A series of pressure tests were conducted by the engineering company to assure perfection. The final product was achieved through the cooperation of engineers of the Regan Forge company and the staff of the Rubbercraft Corporation, the latter headed by R. H. Newall, assistant general manager in charge of production.

The "blow-out preventer" is encased in a steel casing and is subjected to such intense pressure when in use that the inside diameter of 18⅝ inches is contracted to approximately 6⅝ inches. Despite this intense contraction, the finished product shows no signs of surface cracking or weakness in use. Drilling operations are performed while the product is under pressure. Oil-repellent rubber was an essential because the "preventer" comes in contact with crude oil and sour gases. It also acts as a rod-wiper, the drilling pipe being drawn through it while it is under distortion. The mechanical principle involved in the distortion ability of the great block of rubber may be noted in the exterior slashes which will be observed in the accompanying illustration.

To Owners of Noble's "Latex in Industry"

Purchased Prior to November, 1937

The author has prepared an addenda and errata list which represents not only errors in patent numbers and typography but which includes a number of references originally omitted from the book. This list, in printed form which may be readily pasted into the original copy, is available without cost. Address requests to THE RUBBER AGE, 250 West 57th Street, New York City.

Charles Goodyear

CONNECTICUT YANKEE AND RUBBER PIONEER

By P. W. Barker

CHAPTER 7

Goodyear Discovers Vulcanization and His Troubles Only Begin

AFTER being practically dismissed from the Roxbury India Rubber Factory, without cash or income, Charles Goodyear purchased a broken-down rubber manufactory and employed Nathaniel Hayward at a salary of $800 a year. How this man could do things without cash will always be a mystery. It probably was the appearance of exultation in his clear blue eyes, his gentle convincing manner. When he had a few dollars he gave them freely, with promises of future largess.

Goodyear Purchases Sulfur Patent

Upon inspection of his new plant, Goodyear and Hayward discussed the merits of sulfur in rubber manufacture. Hayward claims that after this discussion he was convinced of the beneficial effects of sulfur on a rubber mixture, especially as Goodyear told him that he also had tried it and had found that it had some important effect on India rubber. Goodyear was generous, too, for he assisted Hayward in securing a patent by drawing up the specification, O. B. Coolidge doing the actual writing, and then purchased it of Hayward. U. S. Patent No. 1090, February 24, 1839, Nathaniel Hayward of Woburn, Assignor to Charles Goodyear, of Boston, Mass., "Improvement in Mode of Preparing Caoutchouc with Sulfur for the Manufacture of Various Articles," was the title of patent when finally granted.

Goodyear gave Hayward $100 in cash, a note for $900 payable in six months, and the privilege of making 300 yards of rubber goods a day until an additional $2,000 was paid. It has always been debatable just how much actual cash Hayward received for assigning this important patent to Charles Goodyear, as he has told several different versions of the transaction. It is believed, however, that in the end, after the lapse of years, Hayward was fully compensated.

Immediately after purchasing the Eagle India Rubber Company and obtaining the services of Nathaniel Hayward, Charles Goodyear began operations at full capacity, at Woburn. He had obtained four or five thousands of dollars for sale of license in his acid gas process, but this money was not to last long. His family, which then consisted of his own wife and children, his aged parents, and the families of his two younger brothers, Robert and Amasa, Jr., and Nelson, his bachelor brother, all lived together at Roxbury. They had very pleasant quarters at the Norfolk House, the sitting-room being devoted to the display of numerous applications of rubber. Mrs. Charles Goodyear capably acted the part of a very gracious and charming hostess to the many and sundry visitors whom Goodyear was able to interest in the new manufacture.

Dividing his time between his own factory at Woburn and that of Baldwin and Haskins at Lynn, Goodyear had Hayward manufacture a great number of life-preservers, several thousands of which (he says) were sold and distributed throughout the country. A large proportion of white lead and other coloring agents was used in the composition of these articles, which the inventor felt sure was responsible for their failure with the return of warm weather. Poor Goodyear! He never knew when he was defeated. He was to realize from the numerous complaints of dissatisfied customers and the scorn of investors that his acid gas process had at least some defects.

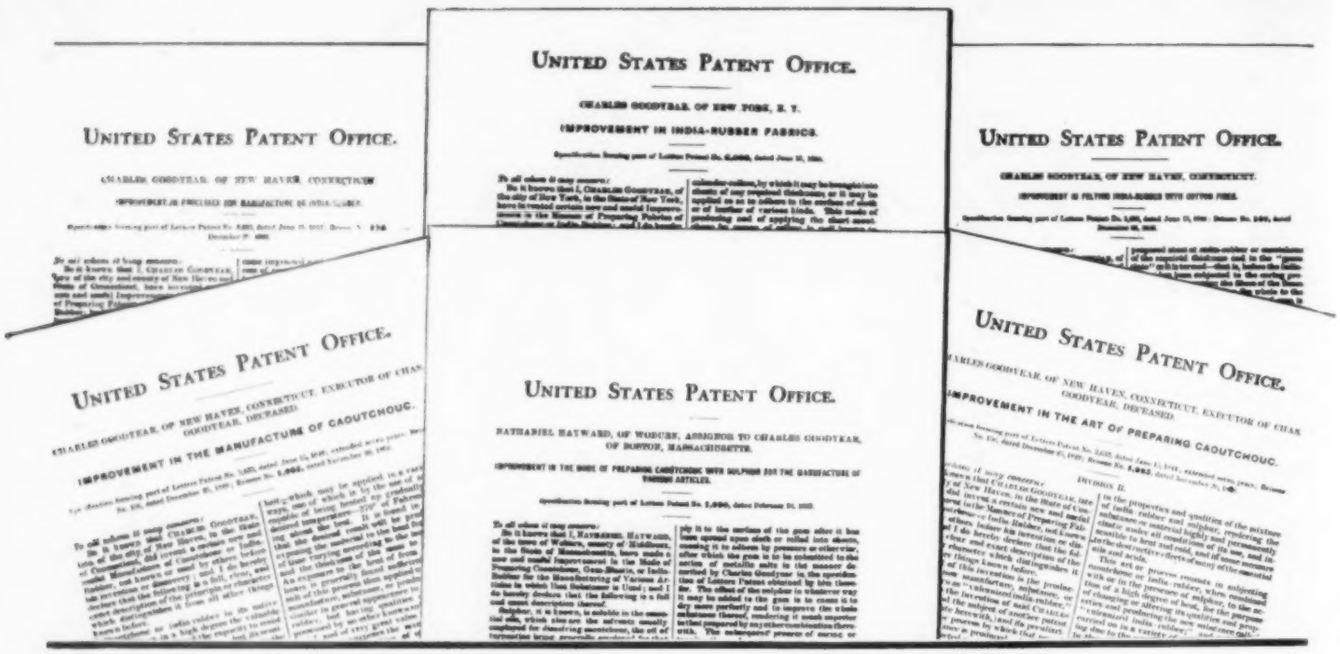
At this juncture, Goodyear's mounting debts overtook him, and everything in his possession was sold under the hammer. Hayward was informed that Goodyear could not continue as owner of the Eagle company. The works again reverted to Hayward, who conducted it under his own name accepting responsibility for payment of rent for the building.

An Important Decision Is Reached

Being broke was nothing new and startling to this man whose mind dwelt in the sticky, smelly mess that was rubber and whose vision was addressed to the stars. Charles Goodyear had the stuff of which martyrs are made. He had not known a well day since his physical breakdown in Philadelphia seventeen years previously, just as he had finished his apprenticeship with Rogers & Brothers.

A little more hunger and debt meant nothing to the

NOTE: This biography of Goodyear started in our April, 1938, issue.


UNITED STATES PATENT OFFICE.

CHARLES GOODYEAR, OF NEW HAVEN, CONNECTICUT.

IMPROVEMENT IN INDIA-RUBBER FABRICS.

UNITED STATES PATENT OFFICE.

CHARLES GOODYEAR, OF NEW YORK, N. Y.

IMPROVEMENT IN INDIA-RUBBER FABRICS.

UNITED STATES PATENT OFFICE.

CHARLES GOODYEAR, OF NEW HAVEN, CONNECTICUT.

UNITED STATES PATENT OFFICE.

CHARLES GOODYEAR, OF NEW HAVEN, CONNECTICUT, EXECUTOR OF CHAS. GOODYEAR, DECEASED.

IMPROVEMENT IN THE MANUFACTURE OF CAOUTCHOUC.

UNITED STATES PATENT OFFICE.

NATHANIEL HAYWARD, OF WOBURN, ASSIGNOR TO CHARLES GOODYEAR, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN THE MODE OF PREPARING CAOUTCHOUC WITH SULPHUR FOR THE MANUFACTURE OF VARIOUS ARTICLES.

UNITED STATES PATENT OFFICE.

CHARLES GOODYEAR, OF NEW HAVEN, CONNECTICUT, EXECUTOR OF CHAS. GOODYEAR, DECEASED.

IMPROVEMENT IN THE ART OF PREPARING CAOUTCHOUC.

Patents for "Improvement in India-Rubber Fabrics" and "Improvement in the Mode of Preparing Caoutchouc with Sulphur for the Manufacture of Various Articles," centered in the above reproductions of early United States patents granted to Charles Goodyear, are the patents on vulcanization of rubber with sulfur and heat, the basic process of the rubber manufacturing industry.

inventor. But what of his family and that of his two younger brothers, as well as his aged parents? Hunger was very real to them and through them to him. Should he still pursue the elusive formula or process for rubber manufacture? Or should he acknowledge defeat and accept employment and livelihood in an entirely different trade or profession? Hardware merchandising was his trade and there were openings for him in it. A living could be made, and his family could again live in simple comfort and enjoy the respect of the community. Goodyear asked himself these questions, but the answers had been in his mind a long time before the questions had gained entrance. He was merely seeking self-justification for proceeding further with his rubber experiments. Yes; he must continue!

The Discovery of Vulcanization

Charles Goodyear now began his travels. From Roxbury to Lynn, to Woburn, back to Roxbury and home—anywhere that rubber was being mixed and experiments undertaken. He tells that on a visit to Hayward's factory at Woburn, "and at the dwelling where he stopped whenever he visited the manufactory" he made a discovery. "He was surprised to find that the specimen, being carelessly brought in contact with a hot stove, charred like leather." The attention of his brother and others who were present was called to the strange occurrence. How many times before had he called them in his excitement over a new discovery? It meant nothing to them. Goodyear, however, saw something in it. "If the process of charring could be stopped at the right point, it might divest the gum of its native adhesiveness throughout, which would make it better than the native gum."

An effort will now be made to fix the time and place of discovery of vulcanization as definitely as possible. Nelson Goodyear, brother of Charles, signed a deposition in a suit at law that he "saw heated rubber first in January, 1839" and that he saw his brother heat a second piece over a candle, at Woburn. John Haskins first saw heated rubber, "early in 1839." Hayward knew of Goodyear's discovery, "In the month of January, February, or March, 1839." Goodyear himself said that, "The discovery was made in the winter" and that, "In the course of the spring 1839 he had succeeded in manufacturing some specimens tolerably perfect, and heating them before an open fire." It would appear rather definite, therefore, that the original discovery was made at Woburn, in January, 1839. If discovery was at the factory, there is only the statement of Hayward to be considered.

But whose was "the dwelling where he stopped whenever he visited the manufactory" at Woburn? It could have been that of Nathaniel Hayward, but it is very doubtful. Goodyear had stopped with Hayward, but had Hayward been present at the moment of discovery he would certainly have known about it and would have known the exact date. Years later Hayward testified that Amasa, Jr., was the first person to show him a piece of "heated rubber."

The most likely place was the home of Elizabeth Emerson. Her residence appears to have been a haven of refuge for the members of the Eagle India Rubber Company; at one time or another practically all of them had boarded with this good woman—Humphrey, Haynes, Martin Hayward, and later, Goodyear's nephew, Austin Goodyear Day. In July of 1841, Elizabeth Emerson boarded the entire family of Charles Goodyear. It is known that Goodyear did experiments at her house, for she testified to this fact in court, saying that, "He put his rubber in oven of my stove, heated rubber on a fire shovel, and nailed specimens on outside of my house."

Type of Stove Used in Experiment

"Charles Goodyear himself soon after told me he had made the discovery by putting a piece of rubber cloth on a hot cylinder stove," according to oath of Nathaniel Hayward, at Colchester, Conn., December

28, 1864. In the same affidavit, Hayward swears that Amasa Goodyear, Jr., (in January, February, or March, 1839) showed him how rubber was vulcanized, by putting a piece of rubber cloth on a hot cylinder stove. Again the cylinder stove. On being placed on the stove by Amasa, Jr., the specimen (again from Hayward's affidavit) "soon began to change color, grow darker, and finally turned to a slate color, when it underwent no further change, and was no longer affected by heat or cold—and all this without injuring the fibre of the cloth. This was at that time called heated or fireproof gum, but afterwards vulcanized rubber."

Problem Only Partially Solved

Goodyear realized the great importance of his discovery, and he also was aware that much must be done before success was final and complete. He told these things to those in the home at which he made the discovery of his success, but to them it meant just another period of hope to be dashed into despair. It was an old story and an old experience to them to see this man reach out and place his hope for success and happiness on an incomplete experiment. It is probable that both Nelson Goodyear and Robert Goodyear were present at the time of discovery. These two younger brothers of Goodyear, both of whom were to sicken and die before him, had tasted the bitterness of poverty, and their enthusiasm for rubber had reached the vanishing point in 1839. It would have been different with Amasa, Jr., the blacksmith, who never lost his enthusiasm for new adventure, and who was to lose his life on one within three years.

The honesty of Goodyear is seen at this time, in his utter poverty and distress, in his refusal to sell his acid gas process to the French firm of Rattier & Guibal, because he knew that he had made a far more important discovery. But Charles Goodyear knew that work must yet be done before his new process was a complete success, and he gives a hint of it in, "If the process of charring could be stopped at the right point?"

Discovery Was Not an Accident

Charles Goodyear was always slightly piqued when persons remarked that the discovery of vulcanization, like that of many another discovery, was largely accidental. He uses the words, "specimen, being carelessly brought in contact with a hot stove." And he further remarks, "While the inventor admits that these discoveries were not the result of *scientific* chemical investigations, he is not willing to admit that they were the result of what is commonly termed accident; he claims them to be the result of the closest application and observation."

James C. Lawrence in *The World's Struggle with Rubber: 1905-1931*, has summarized the achievement of Goodyear in this excellent manner:

"Charles Goodyear, therefore, founded the rubber industry on five variables:—

"(1) Rubber, which could vary with every tree, with every Indian who prepared it for shipment, with methods of packing, shipment, and storage, and with methods of preliminary handling in a factory;

"(2) Sulphur, the quantity of which included in every given batch, could range from 1 per cent to 50 per cent of the weight of the rubber;

"(3) Compounding ingredients and activating agents now so numerous as to offer infinite possibilities for varying the character of rubber mixtures;

"(4) Temperature of vulcanization, which varies from that of superheated steam down to the temperature of the room in which work is carried on;

"(5) Time of vulcanization, which may be measured in minutes or in hours."

Yes; with five variables, Charles Goodyear was to learn that the control of the process of vulcanization was a real problem which he had only partially solved.

(To Be Continued)

Yale College, October 14, 1839.

Having seen experiments made and also performed them myself, with the India rubber prepared by Mr. Charles Goodyear, I can state that it does not melt, but rather chars, by heat; and that it does not stiffen by cold, but retains its flexibility in the cold, even when laid between cakes of ice.

B. SILLIMAN

(Benjamin Silliman, Professor of Chemistry, Mineralogy, Geology, Pharmacy at Yale College, appointed 1802, had known Charles Goodyear intimately for several years. Goodyear consulted him on numerous occasions.)

Boston, 3d April, 1841

To All Whom It May Concern:

I hereby certify, that to the best of my knowledge and belief; Charles Goodyear is the true and original inventor of fire-proof India rubber, and of other improvements, caused by the use of large quantities of sulphur and lead, and of heating the same, and by that and other methods of removing the offensive smell, and I am certain that the same has been accomplished by him at a great expense of time and money.

NATHANIEL HAYWARD

Argentina's Rubber Industry

THE domestic rubber manufacturing industry in Argentina increased its production activities to a record level during 1937, according to a report from the American Assistant Trade Commissioner in Buenos Aires. Imports of crude rubber amounted to 8,938 long tons as compared with 5,642 tons in 1936. There are now approximately 45 industrial plants devoted largely to rubber manufacturing, employing more than 3,000 persons, and producing goods valued between $7,500,000 and $8,000,000 annually.

Argentina's rubber industry has reached the stage where it now supplies most of the local demand for tires and tubes, rubber-canvas footwear, heels and garden hose, and a large percentage of the demand for molded mechanical goods, radiator and steam hose, packing, gloves, sundries and novelties. Rubber belting is expected to be added to these products shortly. Four internationally known tires are manufactured in the country, with five brands of tubes being produced.

Use of Chlorinated Rubber Products

CHLORINATED rubber is now generally recognized as a binding medium with unique properties, having particular advantage in two separate directions, *i.e.*, in the preparation of thin films for use as protection against chemical agents, acidic gases, vapours, water and sea water, and as a binding medium for paints. Along with the increasing use of chlorinated rubber in commercial products has come advanced knowledge with respect to how earlier mistakes in the application of these products may be avoided. In a paper delivered recently before the Birmingham Paint, Varnish & Lacquer Club of England, Dr. Otto Jordan outlined a number of these earlier errors and offered corrective suggestions. The following paragraphs are excerpts from his talk.

It is basically essential to use a product of absolute stability. A great number of methods of testing the stability have been suggested, but it has been proved that the only reliable one is that in which the chlorinated rubber is dissolved in toluol or xylol and warmed on a water bath in a flask, at the top end of which is fixed a small piece of Congo paper, moistened with water. In products with good stability it is barely possible to detect the splitting off of hydrochloric acid after several hours or even days. The results obtained by this test correspond with those produced on exposure of paint films in the open air.

A very frequent source of error lies in the insufficient preparation of the undersurface. Iron, for example, must be free from rust, dry and free from grease. Iron surfaces on which ordinary oil-red lead primers adhere well and give good results are not necessarily suitable for the application of a permanent chlorinated rubber coating. It is particularly important that all loose rust should be removed.

When considering the painting of wood, it must be realized that chlorinated rubber, in a similar manner to nitrocellulose, is a product consisting of large molecules, and, therefore, does not penetrate as deeply into the pores of the wood as does an oil, which has a low molecular weight. Thus the adhesion to wood is also less satisfactory. If the wood is first treated, however, with a 20% solution of an alkyd resin or a suitable solution of a drying oil and then allowed to dry, the chlorinated rubber film binds very well on to the primer, and wood painted in this manner will withstand even severe exposure. When stone or concrete is to be treated with a chlorinated rubber paint, it is necessary to work with a very dilute paint containing only a little pigment.

Another point of importance is how the complete system of paint has been built up. It is often believed that it is only necessary to apply a chlorinated rubber paint on to an oil-red lead primer to produce a good protection against chemical attack. This is, however, not the case. Severe exposure to sea water, etc., sooner or later causes blisters to form on work of this kind. This occurence can be avoided with certainty if a chlorinated rubber primer containing no oil is used. Only when less severe requirements are to be met is it possible to work with red lead in conjunction with mixtures of chlorinated rubber, drying oils, and synthetic plasticizers. This may be effected simply, for example, by adding a suitable solution of chlorinated rubber to the usual type of oil-red lead primer. At the same time a considerable reduction in the drying time of the oil-red lead primer is produced.

Where a particularly smooth undersurface is encountered on which the usual type of chlorinated rubber primer adheres badly, additions of polyvinyl acetate have been found useful in giving better adhesion, and are also effective to a certain extent on a damp undersurface. Surface coats are subsequently applied to primers of this type. Where particularly high resistance to chemicals is needed they should contain unsaponifiable plasticizers. If especially good resistance to water is required, it is not advisable to incorporate special water-soluble plasticizers (many of which are available) in the surface coat. For under-water work it is of particular interest that properly applied chlorinated rubber paints are not penetrated by barnacle growth in the sea, and therefore make an excellent surface on which to apply subsequently, if necessary, the softer anti-fouling paints which must often be renewed.

The use of chlorinated rubber in conjunction with asphalt offers great advantages. It is a well-known fact that on exposure to light asphalt becomes grey and cracks; on warming it very easily softens and begins to flow; while at low temperatures it becomes brittle. Suitable combinations with chlorinated rubber avoid these disadvantages and do not run on exposure to the sun. At the same time, numerous soft asphalts may be made suitable for hard lacquers, and by the addition of chlorinated rubber and plasticizers, hard asphalt may be used for softer lacquers.

Difficulties may be experienced in spraying chlorinated rubber paints if a particularly high solid content is desired, as it is not always possible to produce a concentration greater than 10% for spraying lacquers. The difficulties may to some extent be overcome, particularly when low viscosity chlorinated rubber is used, by working with a large jet opening and a low pressure. Very satisfactory experience of this type of work has been obtained.

S. A. Laurate and S. A. Stearate

TWO new super-ammoniated fatty acid soaps, S. A. Laurate and S. A. Stearate, respectively, have recently become prominent for special uses, according to their manufacturer, Glyco Products Co., Inc., 148 Lafayette St., New York City. These soaps are water dispersible and upon application dry rapidly to give water repellent films of good lubricating value. They are said to be excellent emulsifying agents which give emulsions whose films do not re-emulsify after drying. They also have good detergent properties and frothing power. These properties have been applied in coating, filling, cleaning, lubricating, insulating and polishing rubber, paper, textiles, leather, etc. S. A. Laurate is a transparent, light-colored paste, while S. A. Stearite is a pearly white. In addition to being "soluble" in water, both soaps dissolve in alcohol.

Rubberizing Process for Hosiery

WEARING qualities of British hosiery are said to be considerably increased by means of a new process of treating finished hosiery with a solution derived from latex. The main features of the process, known as the Duran Process, consist in the application of a solution containing colloidally dispersed rubber hydrocarbons and other ingredients to the finished hosiery, after which the hosiery is dried and submitted to a finishing treatment. The solution is applied to the toe and heel areas, where the wear is greatest, and produces a marked strengthening effect attributed to the combination of the rubber hydrocarbons with the fibres constituting the wool thread. Appearance and feel of the sock are not affected.

New Equipment

Comtor "Watchman"

A DEVICE for indicating by colored lights the correctness of size of rubber coated wire as it comes off the tubing machine, called the "Watchman," has been developed by the Comtor Company, Waltham, Mass. The "Watchman" is used in conjunction with Continuous Comtorgages, Series W, which are used not only on tubing machines, but may also be fitted

with rolls which make them suitable for measuring ribbon and other continuous strip or round shapes. The device operates through electrical contact with the dial indicator on the Comtorgage. The indicator is fitted with a special bezel containing adjustable limit posts which are set just beyond the desired distance from zero. When the size of the wire is within the set limits, a green light in the "Watchman" becomes visible. But when the indicator needle comes within one-half graduation of either limit post, a jump spark is produced and a red light flashes on and remains on until the operator pushes a reset button after he has adjusted the tubing machine. Provision is made for duplication of the lights in a remote location if desired. Standard 120-volt A.C. is used. The "Watchman" measures approximately 9 x 5 x 6 inches and is installed on a post or stand adjacent to the tubing machine. It may be applied to existing Comtorgages, Series W, by fitting the standard dial indicator with the special needle and bezel.

Farrel-Birmingham 6-Inch Tuber

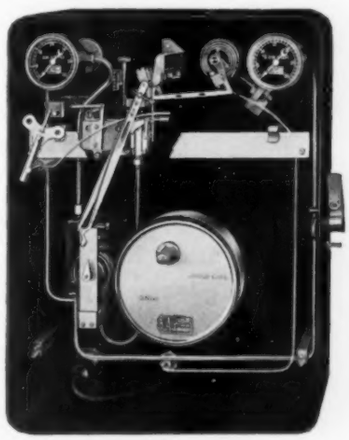
DURABILITY is said to have been increased and maintenance costs decreased by the design of a new 6-inch tubing machine introduced by the Farrel-Birmingham Co., Inc., Ansonia, Conn. The cylinder of the new tuber is made in two parts so that the forward section containing the screw can be removed without disturbing the rear section containing the driving spindle and feed roller gearing. The roller feed maintains a maximum uniform volume of stock to the screw and keeps the cylinder filled to capacity. A constant pitch screw takes the full volume of stock delivered by the feed roller without choking near the die end. There is less "eddying" or slippage and consequently less generation of heat. The motor may be located at either side of the machine as individual conditions may require.

Rotary Dryer for Reclaimed Rubber

THE drying of reclaimed rubber is said to be considerably simplified by means of a new rotary dryer manufactured by the Scottish firm of Bertrams, Ltd., now being introduced in this country by Murray & Jenner, Inc., 11 West 42nd Street, New York. According to the manufacturer, it has been determined that by spraying the scrap rubber sludge or mass on to the hot rolls of this new twin cylinder dryer, a continuous flow of reclaim can be produced at a rate considerably in excess of any reclaim drying method now being used. The dried reclaim is carried by a conveyor to a small sifting machine and delivered from this in the form of a fine, dry powder. Machines can be arranged in units of two or three with a common longitudinal conveyor, elevator and sifter. The cylinders of the new dryer are bored internally for uniform thickness and heating. The knife carriers, which can be raised and locked in a horizontal position by means of suitable worm gear, are said to be exceptionally rigid, having box section backs. Perfect contact between knives and cylinders throughout the entire length is assured by means of fitted multiple hand wheels and screws. Two general types of the new dryer are being featured, one designed for a steam pressure of 50 pounds per square inch, the other for 80 pounds per square inch. Production speed depends upon type or size of the machine. These dryers are said to be proving successful in England, where several of them have been installed.

Throttling Recorder-Controller

A THROTTLING recorder-controller, which incorporates both a recording thermometer mechanism and an air-operated temperature controller mechanism, mounted within one case and both actuated by the same thermostatic system, has been introduced by the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. The controlling mechanism is in effect a pair of relays which regulate the opening of a diaphragm valve, first



Tagliabue Throttling Recorder-Controller

by detecting small pressure or temperature changes, then converting them to pressure changes and amplifying them to the power necessary to operate the valve against the fluid pressure of the liquid or gas under control. The recording mechanism has the same advanced mechanical construction found in the mechanisms of other instruments featured by the company.

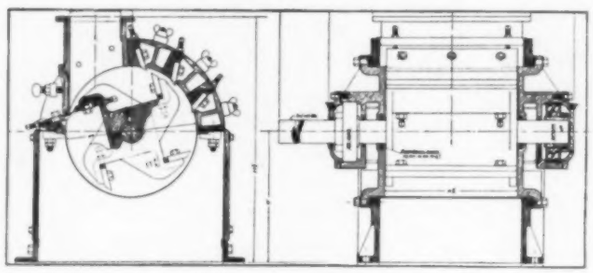
Metco Metallizing Gun

FEATURING improved spraying characteristics, the Type E Metco Metallizing Gun has been developed by the Metallizing Engineering Co., Inc., 44 Whitehall St., New York City. Extremely fine coatings are said to be obtainable with the improved gun at production speeds with continuous operation permitted. Improved nozzle and jet construction reduce gas consumption and result in the deposit of a maximum amount of the metal sprayed. Light weight, perfect balance and an easy hand grip combine to minimize operator fatigue. Two complete speed ranges are made possible by means of a multiple jet turbine, while adequate power is available without changing gears. The new gun requires only 60 pounds of air pressure, and is said to operate equally well from acetylene tanks or generators at the maximum recommended pressure of 15 pounds. The Metallizing process makes possible the restoration of worn machine parts of all kinds, such as bearing surfaces, rolls, shafts, etc., with carbon steels, stainless steels, bronze,

brass, monel metal, nickel, and other metals. The guns used in this process are described as "miniature portable foundries." They melt and deposit any metal which can be obtained in wire form on practically any base material. Compressed air, oxygen, acetylene (or hydrogen), and the metal wire to be sprayed, are required for operation. The gases, held at constant pressure by regulators, are fed to the gun by means of hose. The metal wire is fed through the gun at constant speed. At the nozzle of the gun, the wire is melted by the oxy-acetylene (or oxy-hydrogen) flame, atomized by a compressed air blast, and sprayed out in the form of finely divided molten or semi-molten particles of metal. The particles of metal, upon reaching the surface to be coated, chill almost instantly and key themselves into the crevices or interstices of the surface, effecting a strong mechanical bond.

Unique Heavy Duty Cutter

DESIGNED for cutting, cracking, granulating, flocking, fiberizing and shredding scrap rubber, leather scraps, plastic compounds, pulp, rags, felt, and other materials, a new Unique Heavy Duty Rotary Knife Cutter has been introduced by the Robinson Manufacturing Co., Muncy, Penna. The knife frame consists of cast steel flanges to which steel knife bed bars are welded, this construction producing a substantial one-piece frame that withstands severe service. The ends are removable and are cast integral with the bearing housings. They are arranged with seal rings around the shaft to provide a dust-proof machine. The revolving knives are attached to a massive steel spider, rigidly keyed to a heavy shaft. The balance wheel is



fitted with wood shear pins which shear off and protect the machine from damage in the event metallic substances are introduced into the cutting chamber along with the material. Removable cover plates are placed in front of each stationary knife, allowing the operator to inspect and adjust the clearance between the revolving and stationary knives while they are in their proper cutting positions. A semi-circular screen forms the lower half of the cylinder and holds the material within the cutting chamber until it is cut fine enough to pass through the perforations. Fine or coarse screens can be furnished to meet requirements.

Book Reviews

Molding and Casting: Its Technic and Application. By Carl Dame Clarke. Published by the John D. Lucas Co., Fayette, East and Laurel Streets, Baltimore, Md. 6x9 in. 328 pp. $4.50.

Because the author of this work is Associate Professor of Art as Applied to Medicine at the School of Medicine of the University of Maryland, it is natural that both the text and illustrations pertain to scientific fields. However, the methods of molding and casting outlined, and the formulas given, apply to practices of sculptors and molders in a wide variety of enterprises, both art and commercial. The technic of making rubber, plaster, wax, agar and celluloid molds and casts are explained in detail. Three sections are of special interest to makers and users of rubber molds, *i. e.*, Rubber Molds and Casts, Treatment and Use of Latex, and Directions for Mixing Rubber Molding Materials. The steps in each suggested method are vividly described, with clear-cut illustrations aiding the uninitiated considerably. This volume is one of the few works on the art of molding and casting and constitutes a valuable contribution to the advancement of the knowledge of the art.

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Chlorkautschuk und die ubrigen Halogenverbindungen des Kautschuks. By Dr. Andreas Nielsen. Published by Verlag Von S. Hirzel, Leipzig, Germany. 6x9 in. 124 pp. 6 RM (approximately $2.40 at the current rate of exchange). (Published in 1937; received August 19, 1938).

The development and expanding new uses of chlorinated rubber and other halogen compounds of rubber are described in this book. The author also describes the ground work which started from laboratory research and culminated in the production of chlorinated rubber, in which he played a part, in Germany. In addition to descriptions of actual applications, such as in the paint and varnish industries, suggestions as to other possible uses are included. The book has both an author and a subject index, and the inclusion of an exhaustive patent index makes it of particular value to patent attorneys and inventors.

Booklets, Catalogs, etc.

Photoelastic Determination of Stresses Around a Circular Inclusion in Rubber. By W. E. Thibodeau and L. A. Wood. (A Reprint). 6x9 in. 18 pp. For sale by the Superintendent of Documents, Washington, D. C. 5c per copy.

The possibilities of the use of rubber as a model material are indicated in this booklet, a reprint of an article from the March, 1938, issue of the *Journal of Research,* published by the National Bureau of Standards. The results of an analysis made of the stresses around a rigid circular inclusion with cemented boundary in a rubber sheet which is under simple tension at a distance from the inclusion, performed by the photoelastic method, are given. The authors found that the maximum stresses near the boundary of the disc are about 50% greater than the average applied stress.

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Reporting to Employees on Company Operations. Policyholders Service Bureau, Metropolitan Life Insurance Co., New York City. 8½x11 in. 64 pp.

No standardized procedure has been generally adopted on a method of reporting on company operations to employees, according to this illustrated business research study on the subject, and most companies seem to be pioneering in their own way in trying to show the employee the share he has in the company income and the amount of capital investment needed to make it possible for him to carry on his job and earn his wages. Detailed discussion of how various companies, through new types of statements and with the aid of graphs, photographs and drawings, are seeking to inform their personnel of operating results is given.

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Heat Build-Up Study. (Lab. Report No. 142). General Atlas Carbon Co., 60 Wall Street, New York City. 9x12 in. 2 pp.

Advantages of Gastex over channel black for use in treads on such tires where high heat is encountered was pointed out in an earlier laboratory report issued by General Atlas (Lab. Report No. 136), with comparative data on a channel black tread type compound and a similar compound in which Gastex was substituted given. This latest report gives further data on the comparative behavior on the Goodrich Flexometer of various combinations of Gastex and channel black in a tread type compound. Comparisons are drawn from five separate compounds.

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Handbook of White Pigments. (2nd Edition). Krebs Pigment & Color Corp., 1007 Orange Street, Wilmington, Delaware. 4¾x7 in. 36 pp.

Many new developments which have taken place in the field of white pigments since the introduction of the first Krebs' Handbook are incorporated in this new edition. Additions have been made to each of the major classes of pigments handled by the company, including lithopone, titanated lithopone, titanium dioxide and extended titanium pigments. As in the previous edition, the chemical composition of each type of pigment is given, together with recommended uses.

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Walt Disney Character Merchandise: 1938-39. Kay Kamen, Ltd., 1270 Sixth Ave., New York City. 9x12 in. 100 pp.

All of the manufacturers licensed to produce merchandise bearing the Walt Disney characters, such as Mickey Mouse, Snow White, the Three Pigs, etc., are listed in this catalog, with their products illustrated. Toys by Seiberling Latex, balloons by Oak Rubber, baby pants by American Latex, boots and shoes by Converse Rubber, and rubber stamp sets by Fulton Specialty are included.

Compounding for Permanent Whiteness and Colors, Transparency and "Pure Gum" Type Stocks, Freedom from Odor, Taste and Toxicity, Hollow Articles, and Good Aging Sulfur Chloride Cured Rubber. By Harry G. Bimmerman. (Lab. Report No. 38-8). Rubber Chemicals Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware. 6¼x9½ in. 20 pp.

The compounding principles by which the several characteristics mentioned in the title of this report may be best obtained is discussed therein. To exemplify these various characteristics, practical druggist sundry and similar type formulas were used. These formulas were selected on the theory that no other class of rubber products requires one or more special properties more than the miscellaneous group of articles generally referred to as "druggist sundries." Because the stocks discussed are adaptable to many types of products other than druggist sundries, physical test data is given in most cases.

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L'Emploi des Pneumatiques et autres Applications du Caoutchouc dans l'Agriculture. By Ir. C. Kuijper. The Rubber Stichting, 182 Heerengracht, Amsterdam, Holland. 6¼x9½ in. 34 pp. (In French only).

As indicated by the title (Use of Pneumatic Tires and other Applications of Rubber in Agriculture), the use of tires on tractors, threshers, carts and other farm vehicles is described and illustrated in this booklet, as are uses of rubber in stables, barns, etc. This booklet is somewhat similar in content to that on the same subject prepared by the Rubber Growers Association (of London) last year.

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Tag Indicating, Recording and Controlling Instruments for Temperature and Pressure. (Catalog 1060 D). C. J. Tagliabue Mfg. Co., Park & Nostrand Avenues, Brooklyn, N. Y. 8½x11 in. 64 pp.

In addition to a description and illustrations of the new line of recording thermometers and recording pressure gages with 10 and 12-inch charts, this latest Tag catalog contains complete data on indicating and recording controllers. Practical installation photographs indicate how the various instruments are serving the process industries.

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Thermionic Amplifier. (Catalog E-00A). Leeds & Norththrup Co., 4907 Stenton Ave., Philadelphia, Penna. 8x10½ in. 8 pp.

A complete description of the company's Thermionic Amplifier, which adapts any potentiometer of suitable range for glass electrode measurements and other measurements of potential in high resistance circuits, is contained in this new catalog. The instrument is said to be useful in polarization studies, in measurements of corrosion and oxidation-reduction potentials, and in the measurement of resistors of high values.

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Lucky Strike Plumbing Rubber Specialties. Lavelle Rubber Co., 424 North Wood St., Chicago, Ill. 8½x11 in. 36 pp.

The diversified line of rubber products made by the company for the plumbing and allied trades is illustrated and described in this latest catalog. List prices and specifications are given in each instance. Products shown include tank balls, force cups, cushion rings, washers, stoppers, mats, etc. Most of the company's specialties are sold under the trade name of "Lucky Strike."

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Brown Hygrometers. (Catalog No. 6502). Brown Instrument Co., Philadelphia, Penna. 8 x 10½ in. 28 pp.

The latest additions to the hygrometer line featured by the company, *i.e.*, air-operated humidity controllers (psychrometer type) and a multi-color numeral recording psychrometer, are illustrated and described in this catalog. Also covered is the complete line of Brown recording and controlling hair hygrometers.

Editorial Comment

Continued Ignorance

DESPITE the many years of development by rubber technologists and the wide publicity which rubber antioxidants and odorants have received, there are still many people outside of the rubber industry who believe that rubber must have an offensive odor and will crumble within a short time. It is little wonder then that rubber is not used in many applications to which it is admirably suited.

An outstanding example of the prevailing ignorance on rubber is evidenced by a well-known New York department store, John Wanamaker, which recently published an advertisement telling how its furniture is made, with details given as to why certain materials are used and others are not. Speaking of rubber, the advertisement stated:

> "We don't use rubber and hair combinations. We think it's frightful to slap a sheet of rubber on the back of a chair, for even if it's loaded with talcum powder it may smell and it is apt to pulverize after a while. We upholster the backs and arms of our chairs with curled hair."

It is surprising to find a statement which is so erroneous insofar as rubber is concerned in a discussion which purports to be technical. To the rubber industry the statement is naturally absurd. Yet it serves to show that the rubber industry has not yet convinced large users and prospective users of rubber that this material can be both odorless and compounded to resist almost any chemical or mechanical action to which it might be subjected.

If the Wanamaker statement pertaining to "rubber and hair combinations" refers to rubberized curled hair, then the advertising writer should have known that rubberized curled hair has many definite advantages which have been proved time and time again. It retains its curl longer, has increased elasticity, does not mat down, and is far more hygienic than the hair alone. On the other hand, if latex sponge material is referred to, as indicated by the expression "a sheet of rubber," tests have shown definitely that cushions made of this material can be made odorless, will keep their shape, are sanitary, give extreme comfort, and will outlast other materials.

Rubber in general will actually last longer than most other materials it replaces—whether the other material be steel, bronze, wood, leather or fabric. This is a fact well known to engineers. Therefore, we suggest to John Wanamaker (and any others who hold the same erroneous impression of rubber) that if it really wants to give its customers the advantages of furniture made with industry's newest materials — with long-lasting comfort unobtainable with any other materials—it specify rubber in the arms, seats and backs of its furniture.

Just as tests have shown the outstanding advantages of latex sponge in Pullman and hospital mattresses, bus and theatre seats, and in hundreds of similar applications, just so have they indicated the advantages of rubber in furniture of quality—even of the famed Wanamaker character.

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Congratulations to Everett Holt

CONGRATULATIONS are in order for Everett G. Holt upon his appointment as Chief of the Leather and Rubber Division of the Bureau of Foreign and Domestic Commerce, and we hasten to add ours to the many he has and will receive. Mr. Holt's experience with the Division dates back to 1921 when the Government's Rubber Division was first organized. But the rubber industry, too, has the right to congratulate itself on this appointment for it now has the assurance of a continuance of the outstanding service it has received from the Division for so many years. Any company or individual in the industry that has had occasion to turn to the Division knows the promptness and accuracy with which it furnishes any requested information. Mr. Holt's appointment guarantees continuation of this excellent service.

CURRENT • NEWS of the Rubber Industry

SEPTEMBER, 1938

OUTLOOK FAVORABLE FOR BALANCE OF YEAR

The outlook for the rubber industry for the balance of the year is good, according to the latest survey of the tire and rubber industry made by the Poor Publishing Company, publishers of the well-known *Poor's Surveys*. The improvement in industrial activity, recorded and prospective, assures heavier demand for mechanical rubber products, while, at the same time, greater commercial vehicle mileage will boost truck tire sales.

Improved consumer sentiment and the need of replacing worn out original equipment on the high percentage of cars two to three years old will bolster replacement tire demand, the survey indicates, and the definitely improved prospects for new car sales spells important business from the automobile industry.

Earnings Curtailed Sharply

Manufacturers of tires and other rubber products suffered sharp curtailment of earning power during the first half of their current fiscal periods, the survey reveals. Tire manufacturers were especially hard-hit by the 58% decline in domestic passenger car and truck output, with original equipment tire sales being reduced in proportionate amount. Though replacement sales held up fairly well during the past six months, they were considerably below that of last year when dealers were stocking heavily in anticipation of higher prices. Were it not for the fact that wholesale tire prices held firm while raw material prices were considerably lower, the tire industry as a whole would have operated well in the red.

That second half income will exceed that recorded during the last six months of last year appears a safe assumption, the survey continues, one important factor being the absence of inventory write-downs this year-end. Examination of the income statement of five leading rubber tire manufacturers showed combined income of $4,540,000 for the closing six months of their 1937 fiscal years. Under the unsatisfactory conditions existing in the initial semester of the current year, these concerns earned nearly three million dollars; they should have little trouble earning in excess of 50% more under the more favorable conditions outlined for the second half.

The survey concludes with the statement that the rubber industry enjoys a favorable long-term outlook. Research in rubber is constantly broadening sales horizons. One relatively new line that may become an important source of profit in the near future is a new form of sponge rubber, produced from latex, which is particularly well adapted for use in automobile seat cushions, furniture and mattresses. Another promising field is rubber tires for agricultural machinery.

Clinchers Fading Fast

The "clincher" tire is fast rolling into oblivion, at a rate of more than 100,000 a year, according to Pete Seiler, chief inspector of the B. F. Goodrich Co., Akron, who placed the first set on a machine for Alexander Winton in 1896. Last year some 400,000 clinchers were sold, but this year will see a 40% drop with approximately 235,000 sales, according to Mr. Seiler. Automobile wheels designed for clincher tires were built last in 1924.

1937 CENSUS REPORT ON RUBBER FOOTWEAR

The preliminary report of the Bureau of the Census on the domestic rubber boot and shoe manufacturing industry indicates that a total of 75,794,000 pairs of various types of rubber footwear were produced in 1937, valued at $57,684,000, which compares with 64,794,000 pairs, valued at $48,262,000, in 1935, and 65,295,000 pairs, valued at $41,513,000, in 1933.

The number of pairs in each major classification, and their respective values, produced in 1937, follow: *Rubber-soled canvas shoes*, 30,637,000, valued at $17,548,000; *rubber boots*, 3,884,000 pairs, at $7,625,000; *lumbermans and pacs*, 1,357,000 pairs, at $2,808,000; *arctics and gaiters*, 20,090,000 pairs, at $18,334,000; *other shoes, rubbers and footholds*, 19,826,000 pairs, at $11,369,000.

The report also shows that 11 establishments were producing rubber boots and shoes during 1937, against 12 in 1935 and 13 in 1933. Wages paid by this industry increased 25.5% from 1935 to 1937, and cost of materials increased 31.5%, while the value of products increased only 20.3%.

PROGRAM ARRANGED FOR SAFETY MEETING

The Rubber Section of the National Safety Council will hold its annual meeting on Monday, Tuesday and Wednesday, October 10, 11 and 12, at the Stevens Hotel in Chicago in conjunction with the Silver Jubilee Safety Congress and Exposition of the Council. Papers will be delivered at afternoon sessions scheduled for Monday and Wednesday, with Tuesday designated as "Rubber Section Day" at the Exposition. In addition to several interesting papers, two round-tables, featuring 15-minute talks and 10-minute discussions, have been arranged. Both sessions will be held at the Stevens Hotel.

After opening remarks and submission of the annual report by General Chairman J. A. Kerrigan (U. S. Rubber Reclaiming) at the first session on Monday afternoon, the following papers will be given: *Preventing Windup Accidents*, by R. S. Farnum (U. S. Rubber Products), *Disposing of Alleged Injuries*, by R. W. Morse (Firestone), and *Using Watchmen and Janitors to Promote Safety*, by J. T. Kidney (Goodyear).

Round-Table on Mill Safety

A round-table on "Rubber Mill Safety Problem," featuring the four following papers, will also be held during the first session: *Safe Disposal of Waste Solvents*, by E. F. Foran (Goodyear), *Use of Gloves and Sleeves at Mills*, by R. A. Bullock (Corduroy Rubber), *Prevention of Knife Cuts*, by W. H. McKay (Dunlop Tire), and *Unusual Accidents*, by Urban L. Moler (Inland Div., General Motors).

Election of officers for the 1938-39 season will be held at the start of the second session, on Wednesday afternoon, following which a paper on *The Nurse's Part in Getting Injured Employees Back on the Job* will be presented by Margaret W. Lucal (Ohio Rubber). A round-table on "Specific Hazards in the Rubber Industry" will then be held. In addition to papers on *Calender and Mill Room*, by W. W. Stephen (Goodyear), and *Hand Tools*, by Harry A. Walker (Goodyear), papers pertaining to engineering and molding small rubber parts will be presented. Speakers on these two subjects have not yet been announced. D. G. Welch (Hewitt Rubber), J. L. Grider (American Hard Rubber), A. M. Dietz (Pennsylvania Rubber), and Paul Van Cleef (Van Cleef Brothers) will lead informal discussions of each paper.

SAVINGS ACCRUED FROM TIRE IMPROVEMENTS

Purchasing power of more than 15,000,000 owners of light cars in the U. S. has been increased during the past 12 years by $517,000,000, according to a nation-wide study recently completed by P. W. Litchfield, president of the Goodyear Tire & Rubber Company, Akron, Ohio.

"In the United States today there are 15,260,266 individuals who may be identified as a distinct group through their ownership of light automobiles in the Ford, Plymouth and Chevrolet class," Mr. Litchfield said. "They comprise about 64 per cent of the nation's car owners and, taken with their families, account for almost one-half the nation's total population. Improvements in product and method made by the tire industry during the past 12 years have brought to each individual in this group today a saving of $33.90 in his annual tire bill."

For proof of his statement, Mr. Litchfield cites the fact that tires used on light cars today give an average of 26,500 miles of service, as compared with 14,200 miles delivered by light car tires in 1926; that a tire and tube now costs $19.35 as compared with $23.95 in 1926; that today's tire gives $44.78 worth of mileage on the basis of 1926 values, thus reducing the consumer's tire bill by $25.43 per tire. As the average tire is in service three years, saving for one year is $8.47⅔, and on four tires for one year is $33.90.

"The extra spending money accruing to this entire group of car owners," the Goodyear executive continued, "reaches the staggering sum of $517,000,000 a year. Such a sum baffles comprehension. Stated in more understandable terms this sum, a round half-billion dollars, is an avenue, almost 500 miles long, lined on each side with newly-built homes in the $5,000 class, each with 52 feet of street frontage; 100,000 of these homes, or modern living quarters for all of the people in a city the size of Columbus, Ohio; the total amount expended by our national government during the first 66 years of its existence; the cost of 10 or more super-dreadnaughts for our national defense.

"The story of the tire industry's contribution to public well-being is but one chapter in the record of service rendered by American industries. In other lines of industry, where technological progress has been exercised, other vast contributions have been made. Goodyear, quite naturally, is proud of its part in this record of accomplishment."

J. Strother Miller, director of the technical bureau of the Barber Co., Inc., Philadelphia, has been advanced to the position of technical adviser. He will remain at Barber, N. J., where the company's major plants are located.

Coming Events

Sept. 16. New York Group, Rubber Division, A.C.S., Building Trades Club, New York City.

Sept. 30. Rhode Island Rubber Club, Metacomet Golf Club, East Providence, R. I.

Oct. 4. Los Angeles Group, Rubber Division, A.C.S., Mayfair Hotel, Los Angeles.

Oct. 5-7. American Society of Mechanical Engineers, Providence, R. I. (including a Symposium on Rubber on October 5).

Oct. 10-12. Annual Meeting, N.A.I.T.D., Hotel Jung, New Orleans, La.

Oct. 10-14. National Safety Congress, Hotel Stevens, Chicago, Ill.

Oct. 17-19. Fall Convention, National Ass'n. of Waste Material Dealers, Hotel Sir Francis Drake, San Francisco.

Nov. 4. Boston Group, Rubber Division, A.C.S., Boston.

Jan. 9-13. Annual Meeting, Society of Automotive Engineers, Detroit, Mich.

June 26-30. Annual Meeting, A.S.T.M., Chalfonte-Haddon Hall, Atlantic City.

U. S. Signs Agreement

A contract has been entered into between the Detroit Plant of U. S. Rubber Products, Inc., and the United Rubber Workers of America. The contract, which calls for a six-hour day, thirty-six hour week, time-and-a-half for overtime, and a week's vacation with pay for persons employed at least a year, affects about 5,500 workers in Detroit, according to O. H. Bosley, international representative of the union. The contract also provides for disciplinary action against union and non-union members who fail to live up to the letter of the agreement, the discipline to be meted out by a committee composed of union members and management.

Carbon Black in Canada

The production of carbon black has begun in the Province of Alberta, Canada. A permit for such production was issued by the Alberta Government in 1934 to the Pioneer Carbon Black, Ltd., and three wells were drilled at that time. Lack of capital, however, hindered the new company and its assets, leases, etc., were taken over by Premier Carbon Black, Ltd., last year. In June, 1937, the new company drilled a fourth well and started construction of the first "hot house." This building has been completed and is the first of a battery of sixteen burner houses. Production of carbon black is expected to be comparable with the average United States figure of 1.5 pounds per cubic foot of gas.

PROGRESS STRESSED IN USE OF COTTON

Taking issue with an article appearing in a recent issue of *Time Magazine* to the effect that synthetic rayon cord for automobile tire fabric might displace cotton and therefore lose for cotton farmers one of their largest markets, Wm. D. Anderson, president, Bibb Manufacturing Company, one of the largest producers of cord fabric in the world, pointed to recent developments in the processing of cotton, which, he stated, produced a heat resistant cord far superior to any synthetic type. "Therefore," he added, "there is little likelihood that the consumption of cotton in the manufacture of automobile tires will ever be displaced by any other material."

"The new heat resistant cord we are now producing," said Mr. Anderson, "outlives and outlasts any rubber yet compounded for automobile tires. Cotton fiber is as strong as steel. The tensile strength of cotton cord depends upon the resistance to slippage of the individual fibers. Through a revolutionary new principle in processing cotton, a way has been discovered to soften the natural gums and waxes inherent in every cotton fiber and to fuse the cotton fibers with these gums and waxes as they are rehardened so that they become set and bonded to a degree never before attained.

"The new process provides a cord which retards to a remarkable degree the generation of heat in an automobile tire, but even more important, this new process produces a cord which maintains uniform tensile strength under the high temperatures necessarily generated in any tire when subjected to hard use and heavy loads at sustained high speeds. Under operating conditions this new type heat resistant cord is 25% stronger than ordinary cord and flex breaks have been eliminated.

"With this increased strength comes a more compact, lighter cord, which enables the tire manufacturer to secure the strength and safety of a 6-ply tire with a 4-ply construction. Synthetic cord (rayon) loses a great part of its tensile strength upon contact with moisture. The heat resistant cord prevents 'tire growth' and tread cracks, which cause premature tire failure," Mr. Anderson explained. Leading manufacturers are now using the new heat resistant cord, especially in the manufacture of heavy duty truck tires.

"The future problem of the tire industry is not to find a substitute for cotton," Mr. Anderson concluded, "but to develop new rubber compounds, which will last as long as the heat resistant cord fabric now at the command of the industry."

Angier Changes Name

The corporate name of Angier & Earle, Inc., 120 Potter Street, Cambridge, Mass., has been changed to Angier Products, Inc. The change is merely in name, the general personnel remaining the same, according to President Donald Angier.

Distributed to the
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MICRONEX
Beads or Compressed
Standard for Rubber Reinforcing

FUMONEX
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Semi-reinforcing Black for Rubber

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OXIDES OF IRON
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STEARIC ACID
Stearex Beads
Dispersing and Vulcanizing Assistant

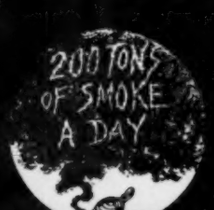
CLAY
No. 1 Full reinforcing · No. 2 Semi-reinforcing
Rubber Filler

PARMR
Mineral Rubber

CARBITUM
Reinforcing and Plasticising Coal Tar Hydrocarbon

BINNEY & SMITH CO.

41 East 42nd St.



New York, N.Y.

FINANCIAL NEWS

GOODYEAR TIRE HAS PROFIT OF $1,669,828

A net income of $1,669,828 for the first six months of the current year was reported by the Goodyear Tire & Rubber Company and its subsidiaries. This was equal, after dividend requirements on 650,468 shares of $5 preferred stock, to 2 cents each on 2,059,060 shares of common stock outstanding. Consolidated earnings, before interest and other charges, and after providing $4,034,178 for depreciation and provision for Federal income taxes, amounted to $3,507,320. For the first six months of the previous year Goodyear reported earnings of $8,068,352, equal to $3.18 each on common shares after preferred dividend requirements.

Consolidated net sales for the half year amounted to $78,151,636, as compared with sales of $116,475,700 in the corresponding period of 1937. Raw material inventories, including forward commitments and the rubber and cotton contents of finished products throughout the world, are carried at cost or market, whichever is lower, at $67,293,398. Previously reserved sums are ample to cover any excess cost.

The consolidated balance sheet as of June 30 shows current assets of $106,118,139, including inventories but less reserves for bad debts, discounts, and allowances, and current liabilities of $9,206,682, a ratio of 11½ to 1. Earned surplus at the end of June 30 amounted to $20,138,747, as compared with earned surplus of $21,421,861 at the end of December 31, 1937. Capital surplus was shown at $18,833,138. It was pointed out that since 1929 obligations senior to the common stock had been reduced by $37,113,669.

GOODRICH REPORTS LOSS OF $209,551

Operations of the B. F. Goodrich Company and subsidiaries for the first six months of 1938 resulted in a loss of $209,551, after provision for depreciation, interest and Federal income taxes, which compares with a net profit of $3,510,698 for the corresponding period in the previous year after the deduction of $500,000 for addition to the contingency reserve.

Net sales for the six months ended June 30 amounted to $51,913,986, as compared to $78,556,619 for the 1937 period, a decrease of sales volume of approximately 34%. Profit before interest and tax provisions amounted to $1,156,780. The consolidated profit and loss account for the period shows a deduction of $1,259,331 for interest on bonds, debentures, bills payable, etc., and a provision of $107,000 for Federal income tax.

The consolidated balance sheet as of June 30 shows current assets of $73,485,256 against current liabilities of $12,613,780, a ratio of approximately 6 to 1. Inventories were valued at the lower of cost or market, and raw material commitments were at prices below market. Domestic bank loans amounted to $3,500,000 at June 30.

Raybestos-Manhattan, Inc.

First Half: Net loss of $302,351, after all charges and provision of $12,010 for state and Federal income taxes, which compares with a net profit of $1,510,642 for the first six months of 1937. Net loss for the second quarter of the year was $43,101, after all costs and expenses including $184,306 for depreciation and $132,005 for taxes, but before $87,801 for full settlement and expenses of litigation long pending and aggregating $3,000,000. Net loss for the first quarter was $171,448 after depreciation and taxes.

Columbian Carbon Co.

First Half: Net profit of $1,377,072, equal to $2.56 a share on 537,406 common shares outstanding, excluding 10,014 shares held in the treasury, which compares with a net profit of $2,520,686, or $4.69 a share, in the corresponding 1937 period. The 1938 income includes a profit of $1,920 on the sale of securities, while the net for 1937 includes a profit of $121,425 on such sales.

National Rubber Machinery

First Half: Net income of $82,729, after all charges including provision for Federal income taxes, equal to 54 cents a share on 154,000 common shares. Total current assets as of June 30 amounted to $652,650 against total current liabilities of $170,769, according to the balance sheet. The company issued no interim statement last year so no comparisons are available.

Hewitt Rubber Corp.

First Half: Net income of $21,787, equal to 13 cents a capital share, which compares with net income of $200,017, or $1.19 per share, for the corresponding 1937 period. For the quarter ended June 30, net income was $11,096, or 7 cents a share, which compares with $96,464, or 58 cents a share, in the June quarter of 1937, and $10,691, or 6 cents a share, for the previous quarter.

Norwalk Tire & Rubber

Directors of the Norwalk Tire & Rubber Co., Norwalk, Conn., have voted to clear up all arrears on its preferred stock with the declaration of $5.25 a share which also includes the payment due on the stock for the September quarter of the current year.

JAPAN DEVELOPS SYNTHETIC RUBBER

According to a translation of an article in a recent issue of the *Nippon Kogyo Shimbun*, a daily industrial newspaper published in Osaka, Japan, forwarded to the Leather and Rubber Division by the American Trade Commissioner in Tokyo, synthetic rubber production schemes in Japan have been rising in rapid succession on the strength of Government encouragement of substitute industries under the emergency situation.

These developments, it is stated, have apparently reached a stage where production on an industrial scale has become possible. Twelve industrial companies and four experimental stations are understood to have undertaken experiments relative to such commercial production. The butadiene process, the chloroprene process and the "sulphuration" process, or a combination of two of the three processes, have been adopted by the various companies, according to the item.

The Umeno Laboratory is believed to have made the biggest progress in synthetic rubber development in Japan and is said to be making hasty preparations to start a daily production of 5 metric tons in cooperation with the Japan Rubber Company. The Osaka Industrial Experimental Station is also believed to be ready to start early commercial production. In the opinion of the Japanese newspaper it is likely that "synthetic rubber will be commercialized (in Japan) within a few years."

The concluding observation of the Japanese newspaper contradicts previous reports which have appeared in the past year or so indicating that several companies have been producing synthetic rubber in Japan on a commercial basis. It is pointed out by the Leather and Rubber Division that no one has yet claimed the 10,000 Yen prize offered by the Imperial Invention Society (of Japan) for the individual or company that turns out a good synthetic rubber.

May Buy Samson Stock

The United States Rubber Company has offered to purchase all of the outstanding stock of the Samson Rubber Corporation, according to reports in financial circles. The offer was made on the basis of $8.00 a share for the 6% preferred stock and $4.00 a share for the Class B stock. It is understood that a committee of minority stockholders of Samson has recommended acceptance of the offer.

Barr Rubber Active

The Barr Rubber Products Company, Sandusky, Ohio, is working within 10% of its capacity, according to Herbert I. Scott, secretary-treasurer of the firm. Approximately 230 employees are now working, the highest number that has been employed at this season of the year in several years. Export business is reported to be exceptionally good.

RECENT YEARS SHOW SHARP EXPORT DROP

Decentralization of the rubber industry is in reality a world-wide movement which has been accentuated in recent years by tariff barriers and the drive of many countries toward nationalism, according to an article in a recent issue of the *Wall Street Journal*. The effect of these moves has been to sharply reduce the total of rubber products exported from this country while enhancing the importance of foreign subsidiaries of American companies, of the larger foreign companies, and of locally-owned plants abroad.

Drop to One-Third of Peak

Exports of rubber products from the United States have dropped to about one-third of the 1920 peak of $85,436,897. They dropped to $16,364,366 in 1932, rose to $32,084,374 in 1937, and thus far in 1938 are running at an annual rate of about $27,000,000. Opinion in the industry is that our export of rubber products will never regain the $50,000,000 mark. Much of the business has been picked up by foreign subsidiaries of American companies so that the profits still accrue at least in part to domestic concerns but the labor and wages are lost to American workmen.

The export business that remains is largely in tires, repair materials, and mechanical goods. In the first five months this year rubber products exports amounted to $11,036,206, as against $13,050,815 in corresponding period last year, of which $5,520,829 or 50% was in tires and repair materials; $1,789,730 or 16.2% was in mechanical goods; $1,030,558 or 9.3% in semi-manufactured goods; $481,079 or 4.4% in rubber footwear; $449,478 or 4.1% in rubberized fabrics; $941,240 or 8.5% in specialties such as water bottles, gloves, balloons, toys, bands, and erasers; and $597,471 or 5.4% in miscellaneous products.

Growing Foreign Competition

Most severe blow to the American rubber export business in recent years has probably been the displacement of American rubber boots, shoes, heels, and soles by Japanese and Czechoslovakian products, according to the article. Prior to 1931 exports of these products accounted for around 15% of our exports but in that year they dropped to 10.5% and since then have been running around 3 to 4% of the total. Labor costs are the answer since raw materials cost about the same in any manufacturing country regardless of the ocean transportation charges. A pair of cheap rubber soled shoes could be manufactured in this country for approximately 50 cents, of which 25 cents represented materials and 25 cents labor. Japan can make competitive shoes for 30 cents, including 25 cents materials and 5 cents labor.

International decentralization from this country got under way just before the war when American companies followed the automobile industry into Canada with tire plants. Thereafter the stronger American and English companies expanded gradually throughout the world as tariffs, Empire preference treaties, and finally desire of many nations to become self-sufficient made competition more difficult. Plants had to be built abroad to hold foreign business.

Department of Commerce estimates place American investments in foreign rubber manufacturing enterprises at the close of 1936 at $62,483,000 with another $75,000,000 being invested in rubber plantations. Manufacturing enterprise investments, according to the Department, cover 12 plants in Canada, valued at $30,255,000; 8 in Europe, valued at $16,388,000; 4 in Latin America, at $7,449,000; and 6 in Africa, Asia and Oceania, at $8,391,000. These figures have probably been enhanced by several millions of dollars since 1936, and additional plants abroad are now in prospect.

Japan has made the most noteworthy progress in the last ten years in the rubber products export field, according to the article, with the value of exports in 1937 amounting to 52,542,851 yen as against 13,256,429 yen in 1928. Value of footwear exports alone increased from 3,883,648 yen in 1928 to 23,273,657 yen in 1937. Exports of tires and tubes from Japan during this period were approximately doubled.

In the field of tire exports, Japan is seventh, based on estimates for 1936 and 1937, the leading country being the United Kingdom, followed by the United States, Canada, France, Italy and Germany.

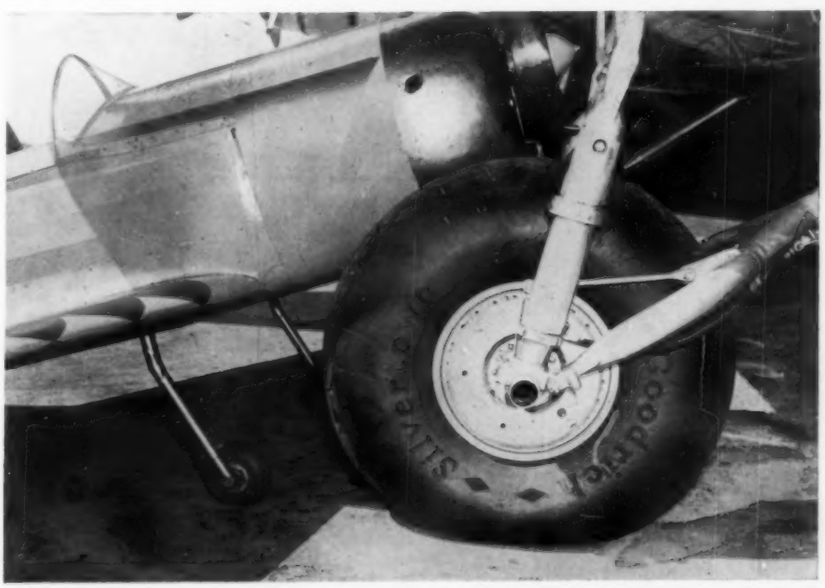
RUBBER SYMPOSIUM PROGRAM COMPLETED

The Committee on Rubber and Plastics of the American Society of Mechanical Engineers, of which Dr. F. L. Yerzley (DuPont) is chairman, has completed its program for the Symposium on Rubber to be held in conjunction with the Fall Meeting of the Society at the Providence-Biltmore Hotel, Providence, Rhode Island, on October 5-7. The papers to be presented at the Symposium will particularly emphasize mechanical problems concerning rubber.

Four papers in all will be presented, the titles and authors of which follow: *The Engineering History of Rubber*, by Dr. W. C. Geer (Ithaca, N. Y.); *Synthetic Substances with Rubber-Like Properties*, by E. R. Bridgwater (DuPont); *Problems in the Production of Rubber*, by E. G. Kimmich (Goodyear); and the *Mechanical Characteristics of Rubber*, by F. L. Haushalter (Goodrich). The first two of these papers will be given at a morning session, scheduled to start at 9:30 A.M., the latter two at an afternoon session. Both sessions will take place on Wednesday, October 5.

Projects for 1939 and 1940 will be discussed by the Committee on Rubber and Plastics at a meeting to be held on the evening of October 5. An inspection trip through the Providence plant of U. S. Rubber Products, Inc., will be held on the afternoon of October 6.

PLANE USES WORLD'S SMALLEST AIRPLANE TIRES



One of the airplanes which competed in the Greve Trophy Races held in connection with the National Air Races at Cleveland last month was the tiny, snub-nosed midget plane dwarfed by a giant American Airlines transport plane in the above illustration. The midget plane, sponsored by the City of San Diego, California, measures 13 feet from nose to tail and 13 feet in wingspread. It is capable of attaining 200 miles per hour. The midget plane is supported by the world's smallest airplane tires, designed by the B. F. Goodrich Company, Akron, for the tailwheel of standard size transport planes. The tires measure eight inches from top to bottom and carry 40 pounds air pressure. The plane weighs 410 pounds.

NEW ENGLAND NEWS

Although net profits of the Fisk Rubber Corp., Chicopee Falls, Mass., for the six months ended June 30 showed a sharp decline from the previous year, earnings have shown steady improvement during the last three or four months, according to Charles E. Speaks, president. Net profits for the first six months were $172,298, after all charges, including provision for normal federal income tax, and are equivalent to 15 cents a share on 439,535 shares of common stock, after preferred dividends. Plant production ran about 60 per cent of capacity during the early months of the year and jumped to 75 per cent in June and July. Satisfactory sales of the new Fisk Safti-Flight tire was said to be a factor in the improvement.

Russell Mfg. Co., Middletown, Conn., announces that its new and exclusive material known as "fused fabric" has been approved by several automobile manufacturers for clutch facings, and that one large company has placed a preliminary order for the material.

Jenkins Bros., Bridgeport, Conn., is building a steel shed at its plant, 510 Main Street, at a cost of $2,000.

Raybestos-Manhattan, Inc., Bridgeport, Conn., has started work on additions at its brake-lining plant in suburban Stratford which will cost $90,000. Principal item is a $40,000 office building to which the Bridgeport offices will eventually be shifted. Other new construction planned includes a steel and brick shipping room, $30,000; a combined garage and laboratory, $12,000; and a frame storage building, $8,000.

Farrel-Birmingham, Inc., Ansonia, Conn., has taken building permits for erection of an extension to its foundry to cost $15,000, and a frame office building, $1,500.

United States Rubber Products, Inc., Naugatuck, Conn., has introduced another new shoe in its Kedette line, called the Stomper. A ladies' sport shoe, designed especially for late summer, fall and winter wear, it has thick soles containing a layer of cork for lightness and comfort.

A number of outings have been held by U. S. R. P. employees this summer. The waterproof stripping department frolicked August 13 at Walonis' Grove, Oxford, with about 75 present. On the same date about 1,000, comprising members of the Naugatuck Chemical Division's Alembic Society, and their families, held an outing at Lake Quassapaug in Middlebury. The largest affair took place at Lake Quassapaug on August 20, attended by 8,000 persons representing footwear division employees and their families. On August 27, 500 employees of the gaytee and gum shoe department went to Playland, Rye Beach, N. Y. The waterproof packing department outing at Schildgen's Grove, Naugatuck, drew 600, and the salvage department had 500 present at Nettleton Farm, Beacon Falls.

Acme Wire Co., New Haven, Conn., is expected to show a profit for the first half of the year, despite the sharp drop in operations compared with a year ago. The company is now operating on a full-week schedule and some departments have been working overtime.

A. E. Newman has been appointed manager of wiring material sales at the General Electric plant in Bridgeport. The appointment consolidates general responsibility for the sales of wiring devices, conduit products and wire and cable. Originally the responsibility for each of these three products was carried by different sales sections. F. A. Parnell has been named sales manager of conduit and J. F. Farnum sales manager of wire and cable. L. T. Giblin becomes supervisor of distribution development for wiring materials and J. P. McIlhenny is now sales manager of the wiring materials field organization.

A. G. Spalding & Bros., Chicopee, Mass., has taken over the vacant plant of Daly Bros. Shoe Company in Brattleboro, Vt., and will equip it for the manufacture of tennis rackets, supplementing production in the main factory at Chicopee. Operations are expected to start in Brattleboro by October 15. Milton B. Reach, president of the Spalding concern, said his concern will enter the low-priced tennis racket field.

Gates Plans New Additions

Gates Rubber Co., Denver, Colorado, is planning the construction of two additions to its factory, one a four-story and basement building, and the other a one-story structure, both measuring 65 by 125 feet. The additions, required for storage and distribution purposes, will cost over $100,000.

Patent Granted to Huber

The J. M. Huber Corporation, New York City, assignee of Howard W. Price, has been granted U. S. Patent No. 2,127,137 covering "Apparatus for Treating Finely Divided Powders." The patent discloses the apparatus in use by Huber for the conversion of carbon black into granular or dustless form.

Baldwin Appeals Decision

The Baldwin Rubber Co., Pontiac, Michigan, has appealed the unfavorable decision against it, handed down by Judge O'Brien in the U. S. Federal District Court at Detroit, to the United States Circuit Court of Appeals at Cincinnati. On July 27, Judge O'Brien entered a decision in favor of the Paine & Williams Company, of Cleveland, in the amount of $101,491, which included interest to that date, against Baldwin. The original suit was brought by the Cleveland concern against Baldwin under a license agreement covering contoured mats for automobiles and was for alleged unpaid royalties under a patent application owned by Paine & Williams covering such mats. A supplemental suit for a later period covered by the same license agreement, according to E. E. Paine, in which the facts are identical, is still pending in the Federal District Court.

Polish Synthetic Rubber

According to an official announcement, Polish scientists have discovered a new process for the manufacture of synthetic rubber, the cost of production of which is no higher than is the cultivation of the natural product. The new material has been named "Ker." It will withstand a temperature of 60° C. without losing any of its properties. The Stomil factory is reported to be in production of tires made from "Ker," while a balloon factory near Warsaw contemplates the production of balloon envelopes from it. One synthetic rubber plant is said to be already in production, with a second one planned.

OBITUARIES

Horace C. Miller

Horace C. Miller, assistant comptroller of the Firestone Tire & Rubber Company, died at the age of 58 in City Hospital, Akron, Ohio, on August 26. Mr. Miller was born in Redding, Conn., attended high school in Danbury, Conn., and later matriculated at the Hill Preparatory School and Yale University. Following graduation from Yale he was associated with various public utility companies in the east and middle west. In July, 1919, Mr. Miller went to Akron and joined the accounting and auditing department of Firestone. In 1932 he was named assistant comptroller and placed in charge of the accounting operations of various subsidiaries. He conducted most of the negotiations leading to the acquisition by Firestone of cotton mills at Gastonia, N. C., and more recently of the latex products plant at Fall River, Mass. Funeral services were held at the First Congregational Church in Akron, with interment in Rose Hill Cemetery. He leaves a widow and two step-sons.

RECORD ATTENDANCE AT BOSTON OUTING

A record crowd, numbering more than 150 member and guests, attended the second annual outing of the Boston Group, Rubber Division, A.C.S., held at the fashionable Weston Country Club, Weston, Mass., on August 19. Ideal weather conditions and a well-balanced program combined to result in a very satisfactory outing. The Outing Committee was composed of James C. Walton (Boston Woven Hose) as chairman, and George W. Smith (Barrett), Alan R. Lukens (Thompson-Weinman), Emil H. Krismann (DuPont), R. J. Noble (Consulting Chemist), and Gladding Price (Vanderbilt).

As usual, a golf tournament was the major sporting event of the day, with 71 members and guests participating. Winners in the tournament were: *Low Gross*—E. M. Rupert, G. E. Wilson and C. K. Mullen; *Low Net*—E. Colligen, A. T. Puschin and J. C. Walton; *Second Low Net*—F. Russell, J. O'Connel and E. J. Mayo; *Kicker*—J. McCarthy, F. E. Rupert and W. H. Peterson; *Highest on One Hole*—W. H. Smith; *High Gross*—T. M. Knowlton. Other prizes went to G. Linberg, J. R. Fisher, A. Ross and R. Patrick. In addition to the golf tournament, there was dart throwing, bowling, tennis, horse racing and other events.

Jim Walton pulled a surprise event during dinner when he conducted a "Professor Quiz" contest between a group of rubber chemists and one composed of salesmen. The chemists' group consisted of H. Liddick (Davidson Rubber), R. Cowen (Quabaug Rubber), Jesse Mason (Haartz-Mason-Grower), and A. A. Glidden (Hood Rubber), with the salesmans' group including E. B. Curtis (Vanderbilt), Bruce Silver (N. J. Zinc), W. Weller (Wishnick-Tumpeer), and C. A. Bartle (DuPont). Top honors went to Mr. Liddick, with Mr. Curtis the runner-up. At the conclusion of dinner prizes were distributed to the winners of the various events and to holders of lucky numbers. The prizes were made possible by donations from the following companies:

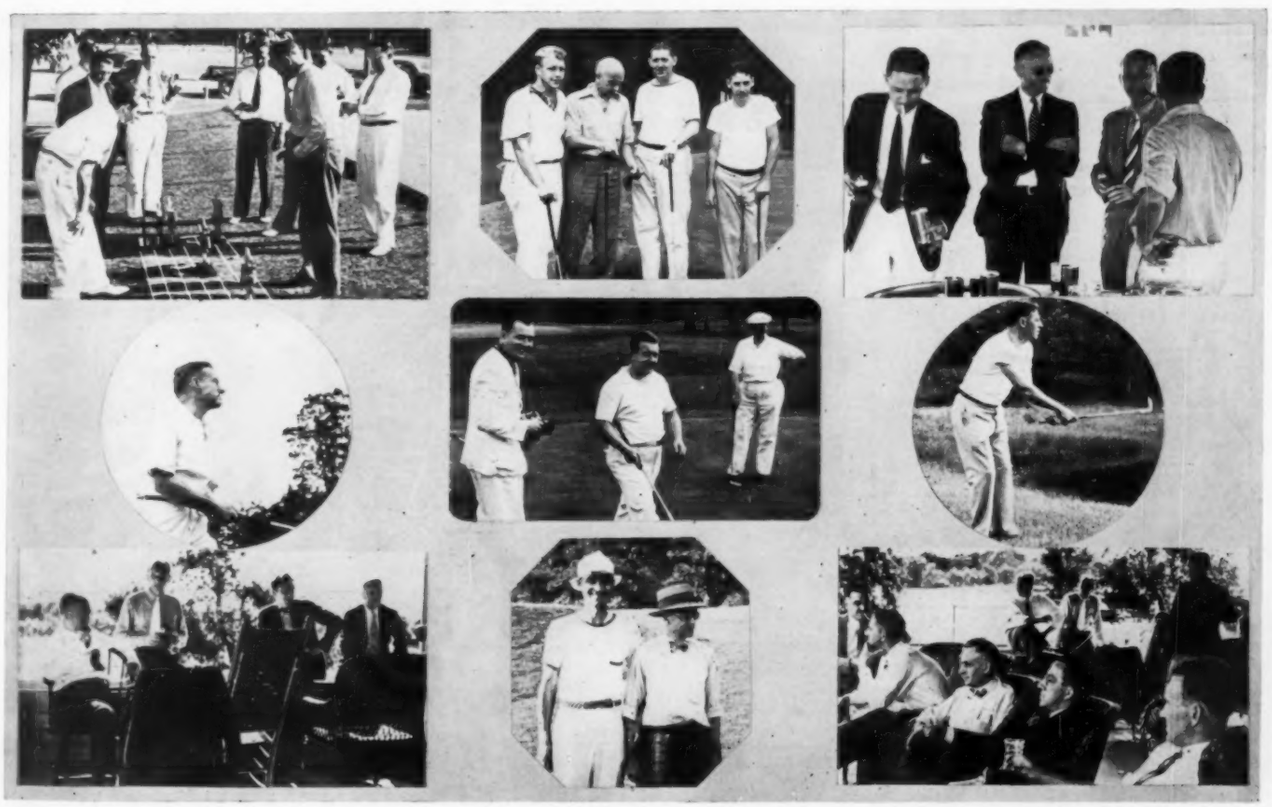
Aluminum Flake Co., American Cyanamid & Chemical Corp., American Zinc Sales Co., Ansbacher-Siegle Corp., Archer Rubber Co., B. B. Chemical Co., Barrett Co., Binney & Smith Co., Bolta Rubber Co., Boston Woven Hose & Rubber Co., Godfrey L. Cabot, Inc., Callaway Mills, Cambridge Rubber Co., Carter Bell Mfg. Co., Chemical Pigment Co., Continental Carbon Co., Colonial Beacon Oil Co., Davidson Rubber Co., E. I. du Pont de Nemours & Co., Wm. D. Egleston Co., W. F. Gammeter Co., General Atlas Carbon Co., Haartz-Mason-Grower Co., C. P. Hall Co., Halowax Corp., Hird & Connor, Inc., Hodgman Rubber Co., Howe & French, Inc., Imperial Paper & Color Corp., *India Rubber World*, Irvington Varnish & Insulator Co., Ernest Jacoby & Co.

Jute Industries, Ltd., Krebs Pigment & Color Corp., D. H. Litter Co., Monsanto Chemical Co., H. Muehlstein & Co., National Sherardizing & Machine Co., Naugatuck Chemical, New England Whiting Co., N. J. Zinc Sales Co., Panther-Panco Rubber Co., Pequanoc Rubber Co., Plymouth Rubber Co., Pratt & Lambert, Inc., Quabaug Rubber Co., THE RUBBER AGE, Russell Box Co., A. Schulman, Inc., Henry L. Scott Co., Stamford Rubber Supply Co., J. P. Stevens Co., Stowe & Woodward, Inc., Taylor Instrument Cos., Texas Co., Thompson, Weinman & Co., Titanium Pigment Co., United Carbon Co., R. T. Vanderbilt Co., Vultex Chemical Co., Webster Cement Co., L. G. Whittemore, Inc., and Wishnick-Tumpeer, Inc.

RHODE ISLAND CLUB MEETS SEPTEMBER 30

The first meeting of the 1938-39 season of the Rhode Island Rubber Club will be held at the Metacomet Golf Club, East Providence, on Friday, September 30. A golf tournament, with prizes for winners of the various events, will be held in the afternoon.

At the business session, held after dinner at the Club, Robert A. Engel, manager, Industrial Aromatics Division, Givaudan-Delawanna, Inc., will deliver a paper on "Unusual Properties and Uses of Aromatic Chemicals." A talk on the business side of rubber with regard to crude rubber brokerage will also be delivered. The speaker for this latter subject has not yet been selected, but it will be a well-known crude rubber broker.



Photographs by George Warren Smith

Various views taken at the outing of the Boston Rubber Group at the Weston Country Club on August 19.

LOS ANGELES NEWS

Frank Beaurepaire, managing director of the Olympic Tyre Company, Melbourne, Australia, spent a couple of weeks in Los Angeles in September. Mr. Beaurepaire heads one of the largest tire repair establishments in Australia. His company takes its name from the fact that he himself was once an Olympic athlete representing Australia. He has inaugurated a profit sharing plan in his company in Australia whereby the workers become stockholders upholding the theory that all connected with a company's success should benefit from profits and not merely stockholders.

William J. Haney, plant superintendent for the Kirkhill Rubber Company, has returned from a trip that took him to New York City, Trenton, Akron, Kansas City and other centers. He visited rubber plants in various localities. Mr. Haney flew directly from Los Angeles to New York, returned to Kansas City from New York by train and then flew from Kansas City to Los Angeles.

C. A. Carlton, manager of the development department for the J. M. Huber Corporation, Borger, Texas, arrived in Los Angeles September 12 for a two weeks business trip through southern California. He planned also to visit various plants in the San Francisco area.

L. Albert and Son, Trenton, N. J., have purchased the reclaiming plant of the R. and H. Chemical Company at El Monte, Los Angeles suburb.

The Samson plant of U. S. Rubber Products, Inc., was running close to its potential output during the months of August and September. Other plants also reported an upswing in production.

The W. J. Voit Rubber Company is in process of erecting a new three-story reinforced concrete building embracing 30,000 square feet of floor space to house the rapidly growing business of the concern. The building will face on Nevin Avenue contiguous with the present building. Rubber balls of all sizes and for all purposes, particularly sports, constitute a major line with this company.

H. W. Rehfeld, formerly connected with the home plant at Akron, has arrived in Los Angeles as the successor of W. R. Hucks who until recently was chief of the compounding division for the B. F. Goodrich Company. Mr. Hucks has been promoted to a position in the receiving department at Akron.

The Goodrich Employees' Recreational Association is making plans to put ten bowling teams into play this fall and winter season. These teams will play weekly, the crack team of the group to take part in an eight-sided tournament later in which the following large industrial firms will be represented: Goodrich, Goodyear, Firestone, U. S. Rubber, Willys-Overland, General Motors, Studebaker, and Chrysler Motors of California.

About thirty men went on the regular fishing trip for supervisors promoted by the rod and gun club of the B. F. Goodrich Company late in August. The club is a division of the Goodrich Employees' Recreational Association and it promotes a large number of fishing trips as well as turkey shoots each year.

F. S. Carpenter is in charge of details of the first autumn supper program of the Los Angeles Rubber Group which will be presented under the auspices of U. S. Rubber Products, Inc., at the Mayfair Hotel, Tuesday evening, October 4. The group under the leadership of Ed Royal, chairman, is busy with an effort to get out at least 150 men for the first supper on the theory that a record attendance at the first meeting will mean a good year. Eight monthly meetings will be held this year as usual, the major tire manufacturing companies alternating in supplying the first four programs. Details of the October 4 program had not been completed by Mr. Carpenter at this writing.

N. Y. Group Meets

As this issue goes to press, the New York Group, Rubber Division, A. C. S., is scheduled to hold a meeting on September 16 at the Building Trades Club, New York City. A technical paper on "The Effect of Temperature on the Mechanism of Oxidation of Rubber. II. Coefficient of Oxidation," by J. H. Ingmanson and A. R. Kemp, of the Bell Telephone Laboratories, and a talk on "Science in Crime," by E. P. Coffey, a member of the Federal Bureau of Investigation, were to be delivered. Full details of the meeting will be given in our next issue.

Form Cementex Company

Robert J. Kenny, Robert E. Curran and Edward Fox have formed the Cementex Company, 336 Canal Street, New York City, for the purpose of selling liquid latex, adhesives and latex compounds. The adhesives will be marketed under the trade name of "Fox Cementex." The Midcontinent Chemicals Corp., 6805 North Clark Street, Chicago, will handle the new company's complete line in the Chicago territory.

Leaders Aiding Congress

Several prominent executives in the rubber industry are lending their aid to the Seventh International Management Congress which will be held at Washington, D. C., from September 19 to 23. It will be the first held in this country. P. W. Litchfield, president, Goodyear Tire & Rubber Co., is serving on the Advisory Council, while R. S. Wilson, vice-president of Goodyear, is a member of the Distribution Committee. Francis B. Davis, Jr., chairman, U. S. Rubber Co., is head of the rubber group of the Commerce and Industry Committee, while Cyrus S. Ching, director of industrial and public relations for U. S. Rubber, is a member of the Personnel Committee. Mr. Ching will also preside at one of the general sessions of the Congress. Col. Charles E. Speaks, president, Fisk Rubber Corp., was one of the early registrants for the sessions.

Prepare Commodity Graphs

The St. Joseph Lead Company, 250 Park Avenue, New York City, has completed the assembly of data and the preparation of two sheets showing graphically the price of a number of commodities over a period of years. One graph is devoted to rubber, gas black, zinc oxide, zinc sulfide, lithopone, titanium dioxide, etc., while the other covers pig lead, basic carbonate white lead, linseed oil, china wood oil, etc. The information given on the graph sheets will be kept up to date with additional issues released from time to time.

Carbon Black in Japan

Several new developments pertaining to the production of carbon black in Japan have recently been reported, according to the American Commercial Attache at Tokyo. The Japan Mining Company is planning to make carbon black from natural gas at a plant to be erected in Formosa. The Japan Carbon Company will shortly start production at its plant in Toyama. A plant at Teine is being planned by the Japan Oil Company. A decided increase in the demand for domestic carbon black is said to lie behind this activity.

To Manufacture Cushions

Manufacture of a new type of rubber cushioning for use in chairs, benches, bar seats and other equipment, will be started within the next few weeks by the Circulair Corporation, a new company, at Cuyahoga Falls, Ohio. Approximately $20,000 is being invested in plant and equipment, according to report. The new company's product was developed in collaboration with Firestone. A. B. Kitselman is president and John Kitselman vice-president of Circulair.

Where is the Nye Rubber Company located? The address of this company, and all other American and Canadian rubber manufacturers, are included in the 1937 RUBBER RED BOOK.

Names in the News

KYLE MENUEZ, recently associated with the mechanical rubber goods division of the Firestone Tire & Rubber Co., Akron, has been appointed comptroller for the Inland Rubber Corporation, Chicago. He was once associated with the India Tyre & Rubber Co., Glasgow, Scotland, and before joining Inland assisted in the development of the new Schacht Rubber Company plant at Noblesville, Ind.

ERNEST I. KILCUP, president, Davol Rubber Co., Providence, R. I., was recently awarded the honorary degree of Master of Science in Business Administration by Bryant Commercial College.

ARTHUR B. NEWHALL, president, Hood Rubber Company, Watertown, Mass., has been elected a vice-president of the B. F. Goodrich Company and a member of the board of directors to succeed JAMES D. TEW, recently resigned. LANGBOURNE M. WILLIAMS, JR., president, Freeport Sulphur Company, was elected a director to succeed COL. ALBERT A. SPRAGUE, also resigned.

DAVE SCOTT, JR., of the Henry L. Scott Co., Providence, R. I., whose engagement was announced last month, was married to HELEN SAFFORD BONNELL, of Chestnut Hill, Philadelphia, on August 23. The wedding took place in historic St. Martin-in-the-Fields, London, England. The couple will return to Providence sometime this month, after a brief honeymoon in England.

A. E. NEWMAN, formerly manager of the conduit and wire and cable sales section of the General Electric Company, has been appointed manager of the wiring material sales section. He will maintain headquarters at the Bridgeport, Conn., plant, and be responsible for the consolidation of sales of wiring devices, conduit products, and wire and cable.

H. S. KARCH, formerly connected with the Lima Cord Sole and Heel Company as chief chemist, is now technical superintendent at the Salem, Ohio, plant of the Martin Custom Made Tires Corporation.

G. P. F. SMITH, assistant to ELMER ROBERTS, vice-president of U. S. Rubber Products, Inc., in charge of the Naugatuck Chemical Division, and vice-president of Dispersions Process, Inc., a U S. Rubber affiliate, has joined the Marbon Corporation, Chicago, where he will assist in the development of rubber hydrochloride products.

EDWARD S. COE, JR., has been transferred from the Buffalo, N. Y., plant of the Farrel-Birmingham Co., Inc., to the Chicago branch sales office where he will promote the sale of the Farrel-Sykes herringbone gears and gear units.

O'Neil Sails for Europe

William O'Neil, president, General Tire & Rubber Co., Akron, sailed for Europe on the *Normandie* on August 31, his first trip abroad in several years. Joseph A. Andreoli, general manager of the General Tire & Rubber Export Company, was among several who sailed with him. Prior to sailing, Mr. O'Neil stated that there were many indications that a seller's market has definitely set in, not only in the tire industry but in many other lines as well. He regarded the present need for more truck tires, which are larger and more expensive than other tires, as "one of the most encouraging factors in the outlook today for the tire industry." He stressed the point that more trucks are needed, which means that entire sets of tires will be required. Mr. O'Neil also revealed that General Tire's replacement sales are now running about 14% behind a year ago, compared with 30% in the first quarter of this year.

Davis Sees Upturn

Interviewed during a visit to Los Angeles, F. B. Davis, Jr., president of the United States Rubber Company, said that there is a general upturn in business and the rubber industry in particular is in good condition. Regarding new frontiers for rubber products he said that the possibility of manufacturing dancing slippers that fit like a glove but do not pinch the foot and golf balls which will withstand the abuse of amateurs are two good prospective fields. "A total of 1,650,000 dozen golf balls were sold in this country in 1937," said Mr. Davis, "and that figure will be exceeded in 1938."

F. L. SUTER, vice-president and treasurer of the Armstrong Cork Co., Lancaster, Penna., was elected first vice-president of the company last month, succeeding the late HUGH M. CLARKE. KEITH POWLISON, assistant treasurer since 1932, was elected treasurer and a member of the board of directors.

C. F. HIRSHFELD, chief of research department, Detroit Edison Company, Detroit, Mich., widely known for his work in connection with rubber springs, was recently awarded the honorary degree of Doctor of Engineering by the University of Detroit.

R. K. GUINZBURG, president, I. B. Kleinert Rubber Co., New York City, writes on "The Sales Convention Rolls Up Its Sleeves" in the August, 1938, issue of the *Executives Service Bulletin*, published by the Metropolitan Life Insurance Company.

HOLT NAMED CHIEF OF RUBBER DIVISION

The appointment of Everett G. Holt as Chief of the Leather and Rubber Division of the Bureau of Foreign and Domestic Commerce has been announced by Dr. Alexander V. Dye, Director of the Bureau. Mr. Holt has been Acting Chief of the Division since October, 1935.

A native of Maine, Mr. Holt received his A. B. degree from Colby College in that State and his LL.B. from George Washington University. Entering the U. S. Civil Service Commission in 1917, as an expert in technical and scientific fields, he rose to the position of Assistant Chief of the Examining Division. In 1921 he was transferred to the newly organized Rubber Division of the Bureau of Foreign and Domestic Commerce. He became Assistant Chief of that Division in the course of the following year, and in 1926 he was made Chief.

In 1930 Mr. Holt went to the Goodyear Tire & Rubber Company for 5 months as Manager of Foreign and Crude Rubber Research. Returning to Washington, he resumed his position as Chief of the Rubber Division in the Bureau of Foreign and Domestic Commerce. In 1933, after a merging of Bureau units, he became Assistant Chief of the combined Leather and Rubber Division.

As Acting Chief of the Division of which he now becomes the Chief, Mr. Holt has steadily striven to establish more intimate contacts with the industries served, to stress the factor of timeliness, to round out the informational facilities, and to enhance the vigor and effectiveness of all forms of trade promotion. Special attention has been devoted to keeping the industries advised as to every new development in the foreign producing and consuming centers. His position makes him a regular consultant of other Government offices on all matters relating to the leather and rubber industries and the trade in rubber and leather products.

MARKETS

RUBBER—COTTON AND FABRICS—CHEMICALS

NEW YORK, SEPTEMBER 12, 1938

Crude Rubber

BETTER cables from abroad, estimates of higher consumption figures, increased activity in the tire replacement field, trade and commission house buying, and a general feeling of optimism with regard to fall business resulted in the steady rise of crude rubber prices during mid-August, culminating in a quotation of 16.58 for spot on the Commodity Exchange on August 24. Occasional recessions in the price were attributed to short weaknesses of the stock market. A wave of profit-taking set in after August 24 resulting in lower prices. General weakness of the stock market, foreign cables, and hesitancy pending the quota decision for the last quarter of the year by the International Rubber Regulation Committee contributed to continued price decline early this month, the price falling to 15.85 on September 9, low for the period. The decision of the Committee to maintain permissible shipments at 45% of export quotas for the October-December period, however, announced on September 10, resulted in an advance of 70 points today (September 12), the price being 16.55. Quotations in the outside market, Exchange, London, and Singapore, follow:

As of September 12

Plantations—

Ribbed Smoked Sheets—

No. 1 Spot	—	@	.16½
October-December	—	@	.16⅛
January-March	—	@	.16⅛
No. 2	—	@	.16⅛
No. 3	—	@	.15⅝
No. 4	—	@	.15⅜
Thin Latex Crepe	—	@	.17¼
Thick Latex Crepe	—	@	.18⅜
Brown Crepe, No. 1	—	@	.15¾
Brown Crepe, No. 2	—	@	.15⅝
Amber Crepe, No. 2	—	@	.15¾
Amber Crepe, No. 3	—	@	.15⅝
Amber Crepe, No. 4	—	@	.14⅛
Brown Crepe, Rolled	—	@	.13⅝

Latex—

Normal, per lb., carload lots	—	@	.19½

Paras—

Up-River, fine	—	@	.15¾
Acre Bolivian, fine	—	@	.16

Balata—

Surinam sheet	—	@	.38

LONDON MARKET

Standard Smoked Sheets—Buyers—September 12

October-December	—	@	8 1/16d
January-March	—	@	8 3/16d

SINGAPORE MARKET

Standard Smoked Sheets—Sellers—September 12

October-December	—	@	7 1/2d
January-March	—	@	7 1/2d

Reclaimed Rubber

Reclaimers report a better demand from the trade during the past month and look forward to further increases this month based on the definite pick-up in the rubber industry and the beginning of production on new automobile models. Consumption of reclaim during August gained appreciably over July, totalling 10,732 tons against 8,273 tons. Current quotations follow:

Shoe

Unwashed	lb.	.06½	@	.06¾
Washed	lb.	.10	@	.10¼

Tube

No. 1 (Floating)	lb.	.12	@	.12¼
No. 2 (Compounded)	lb.	.08	@	.08¾
Red tube	lb.	.08	@	.08¼

Tires

Black (acid process)	lb.	.06¾	@	.07
Black, selected tires	lb.	.06	@	.06¼
Dark Gray	lb.	.09¼	@	.09¾
White	lb.	.11½	@	.12
Truck, Heavy Gravity	lb.	.05½	@	.06
Truck, Light Gravity	lb.	.07	@	.07½

Miscellaneous

Mechanical blends	lb.	.04½	@	.05

Scrap Rubber

(Delivered Akron Mills)

Scrap rubber dealers report slightly better demand from the reclaimers with expectancy of still better demand during the coming month. The stock situation has changed little since our previous report. No changes have occurred in the price structure. Current quotations follow:

(Prices to Consumers)

Auto tire peelings	ton	17.50	@17.75
Mixed auto	ton	10.00	@12.00
Beadless tires	ton	14.00	@16.00
Clean solid truck tires	ton	21.00	@23.00
Boots and shoes	ton	18.00	@20.00
Arctics, untrimmed	ton	12.00	@14.00
Inner tubes, No. 1	lb.	.07	@ .08
Inner tubes, No. 2	lb.	.03¾	@ .03⅞
Inner tubes, Red	lb.	.03¾	@ .03⅞

Cotton

Cotton prices moved erratically during the latter part of August, higher prices occurring on reports of increased mill price fixing, improved sentiment in futures, firmer stock market tone, unfavorable weather reports, and recurring rumors of a Government loan, with price declines attributed to short spurts of selling from abroad, announcement of a Government loan price, larger views with regard to the size of the new cotton crop, and favorable weather reports. High for the period for middling uplands was 8.46 on August 26; low was 8.01 on September 10. In the last week the price has been declining steadily due to almost uninterrupted hedge selling by spot interests, wire houses and practically all hedge channels, in addition to an apathetic trade interest, liquidation of October, and a decided lack of speculative enthusiasm for the bullish side of the market. A "nervous" market is expected until more stable European conditions are assured. Quotations for middling uplands on the Exchange follow:

	Aug. 10	September 12		
	Close	High	Low	Close
October	8.36	7.96	7.86	7.94
December	8.44	7.99	7.90	7.96
March	8.47	7.96	7.87	7.95

Tire Fabrics

(Prices Net at the Mill)

Peeler, carded, 23/5/3	lb.	.27	@ .27¼
Peeler, carded, 23/4/3	lb.	.28	@ .28¼
Peeler, carded, 15/3/3	lb.	.25	@ .25¼
Peeler, carded, 13/3/3	lb.	.24	@ .24¼
Egyptian, carded, 23/5/3	lb.	.40	@ .40½
Egyptian, combed, 23/5/3	lb.	.45	@ .45½

CHAFERS

Carded, American, 1 1/16"	lb.	.27½	@ .28
Carded, American, 1"	lb.	.18½	@ .23

Sheetings

48x40	36 in.	5.50	lb.	—	@ .03⅝
40x40	36 in.	6.15	lb.	—	@ .03¼
40x36	36 in.	6.50	lb.	—	@ .03⅜
48x48	40 in.	2.50	lb.	—	@ .07
48x48	40 in.	2.85	lb.	—	@ .06⅛
56x60	40 in.	3.60	lb.	—	@ .05⅞
48x44	40 in.	3.75	lb.	—	@ .05
44x40	40 in.	4.25	lb.	—	@ .04⅝

Ducks

Enameling (single filling)	lb.	.21	@ .23
Belting and Hose	lb.	.25	@ —
Single filling, A grade	lb.	.09½	@ .12½
Double filling	lb.	.10½	@ .13½

Closing Rubber Prices on New York Commodity Exchange, Inc.

No. 1 Standard Contract of 10 tons

FROM AUGUST 11 TO SEPTEMBER 12

Date		Spot	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sales
Aug.	11	15.97	15.92	15.97	16.00	16.07	16.14	16.17	16.20	16.22	16.26	16.29	16.32	16.36	——	188
	12	16.00	15.91	15.96	15.98	16.06	16.14	16.18	16.20	16.22	16.26	16.30	16.33	16.37	——	308
	13	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	14	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	15	15.85	15.81	15.86	15.88	15.90	15.99	16.00	16.04	16.08	16.11	16.15	16.18	16.22	——	112
	16	16.00	15.90	15.95	15.97	16.00	16.13	16.15	16.21	16.25	16.28	16.30	16.33	16.35	——	253
	17	15.91	15.85	15.90	15.92	15.95	16.08	16.09	16.12	16.15	16.20	16.25	16.28	16.30	——	78
	18	16.00	15.95	16.00	16.02	16.05	16.17	16.20	16.24	16.28	16.31	16.36	16.39	16.42	——	146
	19	16.32	16.27	16.32	16.35	16.40	16.53	16.55	16.58	16.61	16.64	16.68	16.70	16.72	——	513
	20	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	21	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	22	16.39	16.34	16.39	16.45	16.52	16.59	16.59	16.64	16.69	16.73	16.78	16.80	16.83	——	662
	23	16.54	16.49	16.54	16.59	16.66	16.69	16.72	16.77	16.82	16.86	16.91	16.94	16.98	——	637
	24	16.58	16.54	16.58	16.64	16.70	16.74	16.79	16.84	16.89	16.92	16.95	16.99	17.03	——	451
	25	16.52	16.48	16.52	16.58	16.64	16.70	16.75	16.80	16.85	16.89	16.93	16.96	16.98	——	333
	26	16.57	16.53	16.57	16.64	16.71	16.78	16.83	16.87	16.92	16.96	17.00	17.02	17.05	——	341
	27	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	28	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	29	16.12	——	16.10	16.17	16.24	16.31	16.37	16.40	16.44	16.48	16.53	16.57	16.62	——	489
	30	16.25	——	16.25	16.31	16.37	16.44	16.48	16.51	16.54	16.60	16.66	16.71	16.76	——	294
	31	16.32	——	16.30	16.36	16.43	16.50	16.54	16.57	16.60	16.63	16.65	16.70	16.75	——	148
Sept.	1	16.12	——	16.08	16.08	16.19	16.31	16.35	16.37	16.40	16.45	16.50	16.51	16.53	16.57	115
	2	16.27	——	16.25	16.25	16.35	16.44	16.48	16.52	16.56	16.60	16.64	16.68	16.70	16.73	145
	3	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	4	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	5	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	6	16.18	——	16.13	16.15	16.23	16.31	16.32	16.35	16.39	16.42	16.46	16.49	16.52	16.55	360
	7	16.20	——	16.16	16.16	16.26	16.36	16.37	16.41	16.45	16.48	16.50	16.56	16.62	16.67	170
	8	16.12	——	16.05	16.05	16.12	16.20	16.21	16.27	16.34	16.38	16.43	16.47	16.52	16.57	265
	9	15.85	——	15.78	15.83	15.88	15.94	15.96	16.01	16.06	16.12	16.17	16.21	16.25	16.29	317
	10	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	11	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
	12	16.55	——	16.48	16.48	16.54	16.63	16.67	16.70	16.73	16.78	16.84	16.85	16.87	16.90	298

New York Rubber CHEMICAL Markets

New York
September 12, 1938

All Quotations F.O.B. Works Unless Noted

ACCELERATORS

Organic				
A-1 (Thiocarbanilid)	lb.	.26	@	—
A-5-10	lb.	.35	@	.40
A-11	lb.	.52	@	.65
A-19	lb.	.52	@	.65
A-32	lb.	.70	@	.80
A-77	lb.	.42	@	.55
A-100	lb.	.42	@	.55
A-433	lb.	.45	@	.55
Aldehyde ammonia, crystals	lb	.65	@	.70
Altax	lb.	.55	@	.70
Butyl Zimate	lb.	3.00	@	—
Captax	lb.	.50	@	.60
Crylene	lb.	.55	@	.65
paste	lb.	.45	@	.55
Di-Ortho-Tolyguanidine	lb.	.44	@	.46
Diphenylguanidine	lb.	.35	@	.36
El-Sixty	lb.	.57	@	—
Ethyl Zimate	lb.	3.00	@	—
Ethylidene aniline	lb.	.42	@	.43
Formaldehyde aniline	lb.	.37½	@	.42
Guantal	lb.	.45	@	—
Heptene	lb.	.35	@	.40
Hexamethylenetetramine	lb.	.36	@	—
Lead Oleate, No. 999	lb.	.14	@	—
Witco		.15	@	—
Lithex	lb.	.18	@	.20
Methylenedianiline	lb.	.36	@	.37
Monex	lb.	3.25	@	—
Oxynone	lb.	.64	@	.80
Phenex	lb.	.50	@	.55
Pip-Pip	lb.	2.50	@	—
Pipsolene	lb.	1.55	@	1.85
R & H 40	lb.	.40	@	.41
R & H 50-D	lb.	.42	@	.43
R-2	lb.	1.40	@	1.80
R-23	lb.	.40	@	—
Rotax	lb.	.60	@	.65
Safex	lb.	1.20	@	1.25
SPDX	lb.	.75	@	—
Super-Sulphur No. 1	lb.	.50	@	—
No. 2	lb.	.20	@	.50
Thiocarbanilid, drums	lb.	.24	@	—
Trimene	lb.	.75	@	—
base	lb.	1.20	@	—
Triphenylguanidine	lb.	.60	@	—
Tuads	lb.	3.00	@	—
Ureka	lb.	.60	@	.75
Ureka Blend B	lb.	.60	@	.75
Ureka C	lb.	.56	@	.65
Vulcanex	lb.	.42	@	.43
Vulcone	lb.		@	
Vulcanol	lb.	.85	@	—
Z-88-P	lb.	.51	@	—
Zimate	lb.	3.00	@	—
Inorganic				
Litharge, domestic	lb.	.06¾	@	.07¼
Magnesia, calcined, heavy	lb.	.04	@	—

COLORS

Blacks (See Compounding Materials)

Blues				
Prussian	lb.	.36	@	.37
Ultramarine	lb.	.15	@	—
Browns				
Mapico	lb.	.13	@	—
Umber, Turkey	lb.	.04	@	.04½
Greens				
Chrome	lb.	.21	@	—
Chromium Oxide, bbl.	lb.	.21	@	—
Guignet's Green	lb.	.20	@	—
Reds				
Antimony				
crimson, 15/17	lb.	.45	@	—
sulfur, free	lb.	.48	@	.60
Indian English	lb.	.09	@	.10
Domestic (Maroon)	lb.	.11	@	—
Red oxide, pure	lb.	.10	@	.12
Rub-Er-Red, f.o.b. Easton	lb.	.09¼	@	—
Whites				
Cryptone, No. 19	lb.	.05⅞	@	.06⅛
Cryptone CB, No. 21	lb.	.05⅞	@	.06⅛
Cryptone, ZS-20	lb.	.09	@	.09¼
Cryptone, ZS-86	lb.	.09	@	.09½
Lithopone				
Albalith, black label—11 lb.		.04¾	@	.04¾
Azolith	lb.	.04¾	@	.04¾
Ray-bar	lb.	.05⅞	@	.06⅜
Ray-cal	lb.	.05⅞	@	.06⅜
Rayox	lb.	.16	@	.19
Titanox A	lb.	.15	@	.18
Titanox B	lb.	.05⅜	@	.06⅝
Titanox C	lb.	.05⅜	@	.06⅜
Zinc Oxide—American Process				
American Azo:				
ZZZ (lead free)	lb.	.06¼	@	.06½
Anaconda, lead free	lb.	.06¼	@	.06½
Horsehead Lead Free Brand:				
Special—3	lb.	.06¼	@	.06½
XX Red—4	lb.	.06¼	@	.06½
XX Red—72	lb.	.06¼	@	.06½
XX Red—78	lb.	.06¼	@	.06½
XX Red—103	lb.	.06½	@	.06¾
Kadox, black label—15	lb.	.06½	@	.06¾
Blue label—16	lb.	.06½	@	.06¾
Red label—17	lb.	.06½	@	.06¾
St. Joe, black label	lb.	.06¼	@	.06½
green label	lb.	.06¼	@	.06½
red label	lb.	.06¼	@	.06½
U. S. P—7, bbls.	lb.	.09½	@	.09¾
Zinc Oxide—French Process				
Florence White seal—7 bbls.	lb.	.08½	@	.08¾
Green seal—8	lb.	.08	@	.08¼
Red seal—9	lb.	.07½	@	.07¾
Yellows				
Cadmolith	lb.	.50	@	.55
Chrome	lb.	.14½	@	.15½
Mapico	lb.	.09½	@	—

BLACKS

Arrow "Aerfloted" Specification	lb.	.027	@	.036
Bone, powdered	lb.	.05½	@	.12½
Carbon, compressed	lb.	.0435	@	.0775
uncompressed	lb.	.0435	@	.0775
"Certified"	lb.	—	@	—
Spherons	lb.	—	@	—
"Disperso"	lb.	.027	@	.036
Drop, bbls.	lb.	.05½	@	.14
"Excello," compressed	lb.	.0435	@	.0775
"Fumonex"	lb.	.03	@	.07
"Gastex"	lb.	.03	@	.07
Lampblack	lb.	.07	@	.12
"Micronex"	lb.	.027	@	.036
"Supreme"	lb.	.0435	@	.0775
Thermatomic—"P 33"	lb.	.04¾	@	.07¾
"Thermax"	lb.	.01¾	@	.05
United "Dixie" & "Kosmos"	lb.	.027	@	.036

COMPOUNDING MATERIALS

Aluminum Flake	ton.	21.85	@	24.50
Ammonia carbonate, lump	lb.	.10½	@	.12
Asbestine	ton	13.00	@	15.00
Barium carbonate (98-100%)	ton	—	@	—
Barium Dust	lb.	.05	@	.06
Barytes	ton	23.65	@	31.15
Basofor	lb.	.04½	@	—
Bentonite	lb.	.02	@	.03
Blanc fixe dry f.o.b. works	ton	60.00	@	65.00
Calcene	ton	37.50	@	45.00
Catalpo (fact.)	lb.	.02	@	—
Chalk, precipitated				
Suprex white, extra lt.	ton	45.40	@	60.00
heavy	ton	45.00	@	55.00
Clay, Kaolin, domestic	ton	7.50	@	15.00
Aerfloted, Suprex	ton	9.50	@	21.00
Congaree	ton	9.50	@	—
Crown (f.o.b. plant)	ton	9.50	@	—
Dixie	ton	11.00	@	30.00
Dixie, Jr.	ton	9.50	@	29.00
McNamee	ton	9.50	@	22.00
Par	ton	9.50	@	22.00
Witco	ton	9.50	@	—
Cotton Flock	lb.	.11	@	.15
Glues, extra white	lb.	.28	@	.30
medium white	lb.	.14	@	.16
Kalite No. 1	ton	24.00	@	50.00
Kalite No. 3	ton	34.00	@	60.00
"Lime Crest" Industrial Filler No. 100	lb.	—	@	—
Magnesium carbonate	lb.	.07½	@	—
Mica	ton	35.00	@	44.00
Pyrax A	ton	7.50	@	20.00
Rottenstone (powdered)	lb.	.02½	@	.05
Soapstone, powdered	ton	16.00	@	22.00
Starch, powdered	cwt.	2.90	@	4.10
Talc, domestic	ton	17.00	@	20.00
Whiting, commercial	ton	17.00	@	18.00
Columbia Filler	ton	9.00	@	14.00
English Cliffstone	ton	33.00	@	43.00
Witco	ton	7.00	@	—
Wood Flour	ton	20.00	@	25.00
Zinc Carbonate	lb.	—	@	.10¾
Zinc Stearate	lb.	—	@	—

MINERAL RUBBER

285°-300° Mineral Rubber	ton	22.00	@	42.00
Black Diamond	ton	27.00	@	—
Genasco, solid (factory)	ton	25.00	@	27.00
Hard Hydrocarbon	ton	22.00	@	42.00
Parmr, solid	ton	25.00	@	—
Pioneer, MR, solid	ton			
Pioneer-granulated	ton			

MISCELLANEOUS

Aromatics—Rodo #0	lb.	3.50	@	4.00
Rodo #10	lb.	4.50	@	5.00
Curodex 19	lb.	2.75	@	—
Curodex 188	lb.	3.50	@	—
Curodex 198	lb.	4.50	@	—
Para-Dors No. 5145	lb.	2.00	@	—
Aresklene No. 375 (dispersing, wetting and penetrating agent)	lb.	.40	@	—
Darvan (dispersing agent)	lb.	.30	@	.50
Santomerse (dispensing, wetting, penetrating and stabilizing agent)	lb.	.13	@	—
Sunproof	lb.	.35	@	.37½
Sponge Paste	lb.	—	@	.80
Tackol (tackifier)	lb.	.115	@	—
Tonox	lb.	.56	@	.60

SOFTENERS

Acids				
Acetic, 28%, bbls.	100 lb.	2.53	@	2.78
Nitric, 36 degrees	cwt.	5.00	@	6.00
Sulfuric, 66 degrees	ton	15.50	@	16.50
Acids, Fatty				
Laurex	lb.	.15	@	.16
Stearex Beads	lb.	.10¾	@	.11¾
Stearic, double pressed	lb.	.12½	@	.13½
Stearite	lb.	.10½	@	.11¾
Alkalies				
Caustic Soda, 76%	cwt.	3.15	@	3.80
Soda Ash, 58%, C.L.	cwt.	—	@	2.35
Oils				
Cycline Oil	gal.	.20	@	—
Degras, bbls.	lb.	.07¾	@	.08
Fluxrite	lb.	.05½	@	.06½
Palm Niger	lb.	.05½	@	.06½
Para-Flux	gal.	.17	@	—
Petrolatum, light	lb.	.03½	@	.03½
Pigmentaroil, tank cars	gal.	.16	@	—
in drums	gal.	.22½	@	.23½
Pine, steam distilled	gal.	.64	@	.69
dest. dist., drums	gal.	.49	@	.50
Rosin Oil, cmpd	gal.	.40	@	—
Rubberol, f.o.b. Chicago	lb.	.13½	@	.14
Rubtack	lb.	.08	@	.10
Seedine, c.l.	lb.	.07¼	@	—
Tackol	lb.	.08½	@	.18
Witco Palm Oil	lb.	.07	@	—
Witco Softener No. 20	gal.	.20	@	—
Woburn No. 8, c.l.	lb.	.06	@	—
Wobonite, c.l.	lb.	.05	@	—
Resins and Pitches				
Pitch, Burgundy	lb.	.05½	@	.06½
coal tar	ton	19.00	@	22.00
hardwood	ton	16.00	@	22.50
pine, 200 lb. gr. wt.	bbl.	6.00	@	6.50
Pigmentar, tank cars	gal.	.16	@	—
in drums	gal.	.22½	@	.23½
R. S. L. Resin	lb.	—	@	—
Retort Pine Tar, drums	ton	20.00	@	26.00
Solvents				
Acetone, pure	lb.	—	@	.06¼
Alcohol, denatured, methanol, No. 1 bbls.	gal.	.33	@	.39
Benzene, 90%	gal.	.18	@	.23
Beta-Trichlorethane	gal.	—	@	.20
Bondogen	lb.	.98	@	1.65
Carbon, bisulfide	lb.	.05¼	@	.08
Carbon tetrachloride	lb.	.05¾	@	.08¼
Dichlorethylene	lb.	—	@	.25
Dipentene, cml., drums	gal	.41	@	.50
Dryolene (f.o.b. Okla.)	gal.	.10	@	10½
Ethylene dichloride	lb.	.05½	@	.06¼
Plastogen	lb.	.07¾	@	.12½
Reogen (drums)	lb.	.11½	@	.20
Rub-Sol (f.o.b. Okla.)	gal.	.09	@	—
Trichlorethylene	lb.	—	@	.09½
Turpentine, spirits	gal.	.43	@	.47
dest. dist., drums	gal.	.33	@	.41
Waxes				
Beeswax, white	lb.	.39	@	.45
Carnauba, yellow	lb.	.46	@	.47½
Ceresin, white, dom.	lb.	.08	@	.11
Montan, crude	lb.	.10¾	@	.11¾
Paraffin (c.l.—f.o.b. N. Y.)				
Yellow crude scale	lb.	.02¾	@	—
White crude scale 124/126	lb.	.02¾	@	.03
Refined, 122/127	lb.	.04½	@	—

ANTI-OXIDANTS

Agerite Alba	lb.	1.50	@	2.10
Exel	lb.	1.00	@	1.40
Gel	lb.	.57	@	.77
Hipar	lb.	.65	@	.92
Powder	lb.	.52	@	.73
Resin	lb.	.52	@	.73
Resin D	lb.	.52	@	.73
White	lb.	1.25	@	1.75
Albasan	lb	.70	@	.75
Antox	lb.	.56	@	—
B-L-E	lb.	.57	@	.60
Flectol H	lb.	.54	@	—
Flectol White	lb.	1.00	@	—
Flectol B	lb.	.54	@	—
Neozone	lb.	.63	@	—
Oxynone	lb.	.68	@	—
Perflectol	lb.	.67	@	.75
Retardex	lb.	.35	@	.40
Santoflex A	lb.	—	@	—
Santoflex B	lb.	.54	@	—
Stabilite	lb.	.57	@	.62
Stabilite Alba	lb.	.70	@	.75
VGB	lb.	.55	@	.60

MOLD LUBRICANTS

Aresklene	lb.	—	@	—
Cocoa Soapstock	lb.	.06	@	.08
Dipex	lb.	.06	@	.08
Lubrex	lb.	.25	@	.30
Mold Paste	lb.	.18	@	—
Rubberol, f.o.b. Chicago	lb.	.13½	@	.14
Rusco, f.o.b. Nitro	lb.	.25	@	.30
Sericite, f.o.b. N. Y.	ton	65.00	@	—
Soap Tree Bark, cut, sifted	lb.	.06	@	.08

FACTICE OR RUBBER SUBSTITUTES

Amberex	lb.	.19	@	—
Black	lb.	.07	@	.13½
White	lb.	.085	@	.15¼
Brown	lb.	.085	@	.14
Neophax	lb.	.11	@	—

VULCANIZING INGREDIENTS

Dispersed Sulfur No. 2	lb.	.07½	@	.15
Sulfur Chloride, yellow (drs.)	lb.	.04	@	—
Sulfur flour,				
Refined, 100% pure (bags)	cwt.	2.50	@	3.65
Commercial (bags)	cwt.	1.60	@	2.35
Telloy	lb.	2.00	@	—
Vandex	lb.	2.00	@	—

Crude Rubber
Latex and Guayule
Reclaimed Rubber
Tires and Tubes

STATISTICS OF THE INDUSTRY

Rim Production
Automobiles
Gasoline
Cotton Prices

U. S. Imports and Exports of Crude Rubber

YEARS	Gross Imports: Long Tons	Gross Imports: Total Declared Value	Gross Imports: Average Declared Value per pound Cents	Re-exports: Long Tons	Re-exports: Total Declared Value	Re-exports: Average Declared Value per pound Cents	Net Imports: Long Tons
1922	301,076	101,843,188	15.10	4,809	1,921,828	17.84	296,267
1923	309,362	185,060,304	26.71	8,772	5,672,319	28.87	300,590
1924	325,899	173,367,272	23.75	10,309	6,057,637	26.23	315,590
1925	393,370	426,167,504	48.36	14,827	19,847,753	59.76	378,543
1926	409,944	501,131,064	54.57	17,671	22,470,583	56.77	392,273
1927	424,733	338,688,492	35.60	27,775	24,735,488	39.76	396,958
1928	432,633	242,727,423	25.05	32,159	18,128,761	25.17	400,474
1929	560,082	239,177,811	19.06	36,485	16,868,718	20.64	523,597
1930	482,083	139,133,048	12.88	30,205	9,310,205	13.76	451,878
1931	497,176	72,922,845	6.55	25,595	4,255,572	7.42	471,581
1932	409,556	31,936,459	3.48	20,930	2,015,612	4.30	388,626
1933	407,817	44,034,064	4.82	20,537	2,601,352	5.65	387,280
1934	449,513	97,929,676	9.73	23,848	5,770,109	10.80	425,665
1935	453,134	115,299,448	11.36	11,389	3,084,331	12.09	441,745
1936	467,064	152,072,496	14.54	12,581	4,488,223	15.91	454,483
1937	574,600	237,307,041	18.44	7,902	3,385,433	19.02	566,698
1937:							
June	47,073	22,559,545	21.39	807	390,542	21.60	46,266
July	41,493	19,010,273	20.45	767	300,301	17.48	40,726
Aug.	48,020	20,595,314	19.15	670	265,298	17.69	47,350
Sept.	55,123	22 119,248	17.91	668	280,741	18.76	54,455
Oct.	51,171	20,250,893	17.67	450	172,466	17.13	50,721
Nov.	51,958	19,905,523	17.01	159	66,501	18.72	51,799
Dec.	68,006	24,934,206	16.37	290	91,764	14.14	67,716
1938:							
Jan.	43,984	15,115,732	15.34	325	118,514	16.27	43,659
Feb.	39,380	13,095,429	14.85	305	109,756	16.08	39,075
Mar.	41,592	13,494,654	14.48	646	198,865	13.74	40,946
Apr.	31,042	9,495,476	13.66	250	75,797	13.55	30,792
May	27,229	8,010,250	13.13	528	167,831	14.20	26,701
June	25,983	7,150,115	12.29	399	116,458	13.03	25,584
July	21,771	5,723,381	11.74	420	127,522	13.54	21,351

* Revised.

Note: "Gross Imports" do not include latex or guayule. To secure more accurate figures for "Net Imports" latex and guayule figures (shown below) should be added and the re-export figure deducted from the total. Annual figures for 1922, however, include both latex and guayule; guayule only is included in 1923. Annual figures for 1922-36 were revised in February, 1937.

United States Imports of Guayule, Balata, Jelutong, Liquid Latex

(All Quantities in Long Tons)

	Guayule Tons	Guayule Dollars	Balata Tons	Balata Dollars	Jelutong Tons	Jelutong Dollars	Liquid Latex (1) Tons	Liquid Latex (1) Dollars
1924	1,356	536,392	464	568,456	6,165	1,237,100	2,157	864,059
1925	3,781	1,803,448	517	574,750	6,749	1,642,531	3,272	3,537,510
1926	4,305	2,562,096	354	327,213	7,263	3,127,757	3,394	4,686,743
1927	5,018	2,674,957	582	477,246	7,785	2,448,657	1,495	1,170,650
1928	3,077	1,755,685	731	430,855	7,552	2,540,059	4,007	2 121,786
1929	1,275	545,175	728	566,964	8,204	2,458,126	3,729	1, '88,391
1930	1,096	347,388	502	422,684	5,907	1,403,244	4,458	1,508,786
1931	....	.....	1,207	411,380	5,777	1,019,010	4,675	888.909
1932	....	.....	707	147,403	4,607	616,596	5,112	601,999
1933	....	.....	1,659	2,261,869	5,990	944.895	11,085	1.833.671
1934	398	75,349	1,054	438,209	4,987	943,752	13,107	3,643.221
1935	459	86,835	615	188,384	5,644	1,063.126	13,533	3,782,222
1936	1,229	286,552	535	199,368	6,163	1,296,364	19,852	o.659,899
1937	2,694	745,873	354	151,344	7,109	2,017,786	23,185	10,213,670
1937:								
June	147	39,941	91	41,481	488	135,468	2,561	1,253,370
July	371	106,360	22	9,363	533	158,998	1,921	924,127
Aug.	335	95,893	16	5,876	363	107,611	1,801	838,778
Sept.	329	90,822	5	2,196	701	214,511	1,901	839,159
Oct.	247	68,178	29	12,090	460	149,516	1,958	844,205
Nov.	251	69,452	29	9,374	593	194,889	2,085	875,074
Dec.	140	34,347	31	11,491	1,325	470,553	1,804	694,164
1938:								
Jan.	538	147,685	23	8,958	598	224,443	1,400	494,242
Feb.	218	60,097	33	11,393	892	355,080	1,684	560,883
Mar.	150	41,518	69	19,454	587	239,271	979	327,844
Apr.	188	50,423	66	25,741	1,265	444,756	889	295,690
May	229	61,756	29	8,806	900	274,652	879	279,502
June	150	41,518	34	11,406	918	276,126	695	214,420
July	223	49,099	51	16,130	869	267,491	634	209,526

(1) Weight given in pounds of dry rubber contained in latex.

Note: Annual figures for 1924-1936 revised on basis of information received on February 8, 1937.

U. S. Consumption of Crude Rubber

(Rubber Manufacturers' Association statistics raised to 100 per cent—All figures in long tons)

	Figures on Monthly Basis: 1931*	1932*	1933*	1934*	1935*	1936*	1937*	1938
Jan.	28,640	29,648	22,645	39,190	46,636	48,631	50,879	29,429
Feb.	28,880	31,821	21,392	40,515	42,720	36,841	51,950	23,808
Mar.	32,883	29,505	17,843	47,003	42,153	42,813	54,129	30,487
Apr.	33,418	27,518	25,928	44,853	44,247	52,031	51,859	27,984
May	37,927	30,957	44,074	42,918	41,101	50,612	51,795	28,947
June	38,027	41,475	50,743	40,147	36,156	52,772	51,860	30,629
July	32,030	29,976	49,614	32,553	35,917	48,250	43,703	32,209
Aug.	27,666	23,721	44,428	33,216	38,775	46,777	41,506	38,170
Sept.	23,707	23,847	35,281	30,258	37,086	46,449	43,945	
Oct.	22,342	22,286	31,543	31,253	41,969	49,637	38,754	
Nov.	23,010	23,231	28,831	34,748	42,310	50,433	34,025	
Dec.	21,470	18,015	28,757	36,569	42,474	49,754	29,195	
Tot.	350,000	332,000	401,079	453,223	491,544	575,000	543,600	

* Revised.

Note: Figures for 1931-1937 were revised in May, 1938, and are now based on Department of Commerce survey figures.

Reclaimed Rubber in the United States

(All Quantities in Long Tons)

Year	Production	Consumption Tons	Consumption % to Crude	Stocks*	Year	Production	Consumption Tons	Consumption % to Crude	Stocks*
1928	208,516	223,000	50.4	24,785	1933	99,560	81,602	19.9	20,746
1929	218,954	226,588	48.4	27,464	1934	110,010	100.597	22.2	23.079
1930	157.967	153,497	40.8	22,000	1935	122,948	113,078*	23.0*	25,069
1931	133.351	124,126	33.9	19.257	1936	150.571	141,486*	24.6*	19,000*
1932	75,608	77,504	23.4	16,354	1937	178.776	157,990	29.1	26,260

	Figures on Monthly Basis: Production	Tons	% to Crude	Stocks*		Production	Tons	% to Crude	Stocks*
1937:									
Jan.*	15,129	14,450	28.4	18,822	July	16,241*	12,128*	27.8*	17,682*
Feb.*	15.192	14.578	28.1	18,490	Aug.	16,543*	13,227*	31.9*	19,706*
Mar.*	14,462	15.601	28.9	16.450	Sept.	16.410	13,681	37.4	21.597
Apr.	13.884	15,607	30.1	14.046	Oct.	15,849	12.234	31.6	23,572
May	15.793	14,693	28.4	14,647	Nov.	12,406	9.703	28.6	24,620
June	16,052	14,414	27.8	14,535	Dec.	10,815	7,674	26.3	26,260
1938:									
Jan.	8,467	6,673	22.7	27,179	July	7,109	8,273	25.7	18,832
Feb.	6,012	6.867	28.8	26,431	Aug.	10,472	10,732	28.1	17,892
Mar.	6,669	8,573	27.1	24,401	Sept.	.....	.....	...	.....
Apr.	6.399	7,480	26.7	23,339	Oct.	.....	.....	...	.....
May	6,866	8,009	27.7	22,275	Nov.	....	.....	...	.....
June	7,584	8,274	27.0	21,040	Dec.	.....	.....	...	.....

* Stocks on hand at the end of month or year.
* Revised.

Note: Figures for 1936 were revised on June 1, 1937, and are now based on Department of Commerce survey figures.

U. S. Consumption of Gasoline

(Bureau of Mines Statistics)
(In Thousands of Barrels of 42 Gallons)

	1936*	1937	1938		1936*	1937	1938
January	32,344	33,696	35,176	August	46,061	49,597	
February	27,178	32,000	31,861	September	44,366	47,245	
March	35.864	40,561	41,259	October	44,163	45,361	
April	38.864	43,409	43,254	November	39,954	42,666	
May	42,010	45,484	44,911	December	39,590	39,457	
June	44,522	48,580	48,293				
July	46,865	50,704*	47,474	Total	481,606	518,760	

* Revised.

Rims Inspected and Passed in U. S.

(Tire and Rim Association Reports)

	Total		Total		Total
1926	24,199,524	1930	17,364,096	1934	12,255,118
1927	19,700,003	1931	11,253,800	1935	18,664,356
1928	24,247,282	1932	6,261,336	1936	20,790,192
1929	24,141,502	1933	8,713,962	1937	22,257,964

1938		1938		1938	
January ...	527,899	May	706,188	September .	.....
February ..	477,600	June	527,121	October ...	.....
March	854,031	July	406,419	November ..	.....
April	970,545	August	.....	December ..	.....

Daily Spot Closing Prices of Ribbed Smoked Sheet Rubber—*New York Market, in Cents per Pound*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.
1936																																
June	15⅜	15⅝	15¾	15⅛	15⅛	15⅛	—	15⅛	15⅛	15⅛	15⅛	15⅛	15¾	—	15⅛	15⅝	15¾	15¾	15⅛	15⅞	—	22	15⅛	16⅛	—	—	—	—	16⅛	16⅛	—	15⅝
July	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16½	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅝	16⅝	16⅝	16⅝	16⅝	16⅞	—	23⅛	16⅝	16⅝	16⅝	16⅝	16⅞	16⅝	16⅝	16⅛	16⅛	16⅛
Aug.	—	—	16⅞	16⅝	16¼	—	—	16⅝	—	—	16⅝	16¼	—	—	16⅝	16⅝	16⅝	16⅝	16⅝	16⅞	—	23⅝	16⅝	16⅝	16⅝	16⅝	16⅞	16⅝	16⅝	16⅝	16⅝	16⅝
Sept.	—	—	16⅞	16⅝	—	—	—	16⅝	—	—	—	—	—	—	16⅝	16⅝	16⅝	16⅝	16⅝	16⅞	—	23⅝	16⅝	16⅝	16⅝	16⅝	16⅞	16⅝	16⅝	16⅝	16⅝	16⅝
Oct.	16⅞	16⅞	16⅝	16⅝	—	16½	—	16⅝	16⅝	16⅝	—	—	16½	—	16⅝	16⅝	16⅝	16⅝	16⅝	16⅞	—	23⅝	16⅝	16⅝	16⅝	16⅝	16⅞	16⅝	16⅝	16⅝	16⅝	16⅝
Nov.	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	—	17⅜	17¾	—	17⅛	17⅛	17⅛	18⅛	18⅛	18⅛	20¼	—	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18
Dec.	18½	18⅝	18⅝	19	—	—	19⅜	19⅛	19⅛	19	19	19	—	19⅛	19⅛	20¼	20¼	20¼	20⅛	—	20⅛	—	19⅜	19⅜	19⅜	19⅜	—	23	22⅜	21⅜	21⅛	20
1937																																
Jan.	—	—	21⅜	20⅛	20⅜	21⅛	21⅛	21⅛	22⅛	22⅜	22⅜	22⅛	22	21⅛	21⅛	21⅜	21⅜	21⅜	20⅛	21⅛	20⅛	—	20⅝	20⅝	20⅝	21⅜	21⅜	21⅜	21⅜	21⅜	21⅜	—	21⅜
Feb.	21	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	23⅜	23⅛	23⅛	23⅛	23⅛	23⅛	24⅛	24⅛	—	23⅛	24⅛	24⅛	25⅛	25⅛	—	—	26⅛	26⅛	26⅛	24⅞
Mar.	21⅛	21⅜	21⅜	21⅛	23⅛	23⅛	24⅛	24⅛	24⅛	24⅛	24⅛	23⅛	23⅛	22⅝	22⅝	22⅝	22⅝	22⅝	22⅛	22⅛	—	23⅛	23	23	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛
April	26⅛	26⅛	26⅛	24⅛	24⅛	24⅛	24⅛	24⅛	24⅛	24⅛	24⅛	23⅛	23⅛	22⅝	22⅝	22⅝	22⅝	22⅝	22⅛	22⅛	—	23⅛	23	23	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛	23⅛
May	21	21	21	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	20⅞	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	—	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛	21⅛
June	20⅛	20⅛	19⅞	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	—	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛
July	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	19⅝	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	—	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞
Aug.	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	—	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝	18⅝
Sept.	17¾	17¾	17¾	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	17⅝	—	17⅝	17⅝	17⅝	17⅝	17⅝	18	17⅝	17⅝	17⅝	17⅝	17⅝
Oct.	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	—	15⅛	15⅛	15⅛	15⅛	15⅛	15¼	15⅛	15⅛	15⅛	15⅛	15⅛
Nov.	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	—	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½	14½
Dec.	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	—	15	15	15	15	15	15	14⅛	14⅛	14⅛	14⅛	14⅝
1938																																
Jan.	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	—	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞
Feb.	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	—	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞
Mar.	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	—	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞	14⅞
April	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	—	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝	11⅝
May	11⅜	11⅜	11⅜	11⅜	11⅜	11⅜	11⅜	11⅜	11⅜	12	12	12	12	12	12	12	12	12	12	12	—	12	12	12	12	12	12	12	12	12	12	12
June	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	—	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜
July	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	—	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛
August	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	—	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛
Sept.	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	—	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½

Average Spot Closing Prices—Ribbed Smoked Sheets

(New York Market)

Average Price per Pound for Years 1911-1930

Year	Cents	Year	Cents	Year	Cents	Year	Cents	Year	Cents
1911	141.30	1915	65.85	1919	48.70	1923	29.45	1927	37.72
1912	121.60	1916	72.50	1920	36.30	1924	26.20	1928	22.48
1913	82.04	1917	72.23	1921	16.36	1925	72.46	1929	20.55
1914	65.33	1918	60.15	1922	17.50	1926	48.50	1930	11.98

Average Monthly Price per Pound Since 1930

	1931 Cents	1932 Cents	1933 Cents	1934 Cents	1935 Cents	1936 Cents	1937 Cents	1938 Cents
Jan.	8.34	4.38	3.08	9.32	13.10	14.35	21.37	14.63
Feb.	7.70	4.03	2.95	10.45	12.92	15.48	21.33	14.71
Mar.	7.71	3.35	3.01	11.01	11.51	15.89	24.09	13.55
Apr.	6.43	3.02	3.56	12.10	11.55	15.98	23.44	11.84
May	6.49	3.09	4.95	13.26	12.05	15.62	21.14	11.57
June	6.35	2.66	6.15	13.51	12.57	15.85	19.29	12.57
July	6.37	2.89	8.01	14.60	12.10	16.49	18.86	15.37
Aug.	5.38	3.63	7.31	15.47	11.98	16.25	18.37	16.08
Sept.	5.08	3.84	7.30	15.36	11.55	16.46	18.55	
Oct.	4.87	3.65	7.64	13.96	12.62	16.55	16.28	
Nov.	4.65	3.44	8.66	13.04	13.15	17.97	14.60	
Dec.	4.64	3.24	8.87	12.98	13.28	20.01	15.41	
Average for Year	6.17	3.49	5.96	12.92	12.37	16.41	19.39	

London Closing Prices of Ribbed Smoked Sheets

(In Pence Per Pound)

Day	1938 June	1938 July	1938 Aug.	1938 Sept.	Day	1938 June	1938 July	1938 Aug.	1938 Sept.
1	5 9/16	7¼	—	7 7/8	17	5 11/16	—	7 11/16	
2	5 5/8	—	7 11/16	7 7/8	18	—	7 7/8	7 11/16	
3	5 9/16	—	7 11/16	—	19	—	7 7/8	7 7/8	
4	—	7½	7 5/8	—	20	6 1/16	7½	—	
5	—	7¼	7 11/16	7 7/8	21	6 1/16	7 9/16	—	
6	—	7¼	—	7 11/16	22	6 1/16	7 9/16	7 11/16	
7	5	7 7/8	—	7 11/16	23	6 1/16	—	8	
8	5	7¼	7	7 7/8	24	6¾	—	8 1/16	
9	5	—	7 11/16	7 11/16	25	—	7¾	8	
10	5 7/8	—	7 11/16	—	26	—	7 5/8	8 1/16	
11	—	7¾	7 7/8	—	27	6 11/16	7 11/16	—	
12	—	7 5/8	7¾	8 1/16	28	6 7/8	7 11/16	—	
13	5	7 7/8	—		29	6 7/8	7	7 7/8	
14	5	7¼	—		30	7¼	—	7 7/8	
15	5	7 7/8	7¾		31	—	—	7 11/16	
16	5 7/8	—	7 11/16						

Average Monthly Price Per Pound

Month	1935 Pence	1936 Pence	1937 Pence	1938 Pence	Month	1935 Pence	1936 Pence	1937 Pence	1938 Pence
Jan.	6.434	6.758	10.378	7.077	Aug.	5.696	7.581	8.830	7.841
Feb.	6.292	7.255	10.503	7.029	Sept.	5.508	7.577	8.935	
Mar.	5.745	7.450	11.766	6.590	Oct.	6.130	7.898	7.855	
Apr.	5.604	7.502	11.471	5.793	Nov.	6.308	8.572	7.080	
May	5.822	7.335	10.250	5.632	Dec.	6.340	9.580	7.332	
June	6.027	7.352	9.548	6.147	Average				
July	5.801	7.696	9.136	7.464	for Year	5.976	7.713	9.424	

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market)

Recent Daily Price Per Pound

Date	1938 July	1938 Aug.	1938 Sept.	Date	1938 July	1938 Aug.	1938 Sept.	Date	1938 July	1938 Aug.	1938 Sept.
1	9.01	8.61	8.35	11	8.79	8.43	—	22	8.83	8.32	
2	9.12	8.59	8.33	12	8.84	8.27	8.06	23	8.92	8.38	
3	—	8.56	8.22	13	8.67	8.25		24	—	8.32	
4	—	8.61	—	14	8.68	—		25	8.87	8.36	
5	9.03	8.52	—	15	8.69	8.27		26	8.79	8.46	
6	9.21	8.53	8.10	16	8.64	8.33		27	8.76	8.42	
7	9.04	—	8.18	17	—	8.40		28	8.67	—	
8	9.17	8.36	8.19	18	8.72	8.37		29	8.67	8.30	
9	9.03	8.36	8.08	19	8.81	8.42		30	8.72	8.46	
10	—	8.46	8.01	20	8.74	8.42		31	—	8.35	
				21	8.88	—					

Average Monthly Price Per Pound

	1935 Cents	1936 Cents	1937 Cents	1938 Cents		1935 Cents	1936 Cents	1937 Cents	1938 Cents
Jan.	12.70	11.91	13.06	8.57	Aug.	11.48	12.28	10.41	8.41
Feb.	12.58	11.53	13.15	8.91	Sept.	10.80	12.31	9.02	
Mar.	11.63	11.43	14.46	8.92	Oct.	11.28	12.30	8.42	
Apr.	11.73	11.71	14.23	8.76	Nov.	12.01	12.23	7.96	
May	12.25	11.68	13.34	8.50	Dec.	11.99	12.83	8.26	
June	11.89	12.02	12.70	8.38	Average				
July	12.26	13.11	12.26	8.85	for Year	11.88	12.11	11.44	

Stocks of Crude Rubber

(All figures are in long tons)

ON HAND OR AFLOAT TO THE U. S.

End of	ON HAND 1936	1937	1938	AFLOAT 1936	1937	1938	ON HAND AND AFLOAT 1936	1937	1938
Jan.	296,683	204,436	274,581	43,870	55,096	57,356	340,553	259,532	331,937
Feb.	293,631	195,692	294,338	46,532	53,538	47,459	340,163	249,230	341,797
Mar.	284,561	192,980	299,172	58,935	56,994	41,882	343,496	249,974	341,054
Apr.	277,478	176,289	301,436	47,678	72,530	39,071	315,156	248,819	340,507
May	262,415	175,273	299,720	48,860	58,542	32,859	311,275	233,815	332,579
June	245,544	172,056	294,566	47,228	57,215	32,079	292,872	229,271	326,645
July	235,850	167,094	284,914	60,343	75,779	40,400	296,193	242,873	325,314
Aug.	230,167	174,195	277,463	63,597	80,439	47,772	293,764	254,634	325,235
Sept.	233,336	186,193		62,240	83,288		295,576	269,481	
Oct.	224,000	200,025		67,825	80,653		291,825	280,678	
Nov.	211,480	222,707		73,691	81,302		285,171	304,009	
Dec.	223,000	262,204		56,567	63,099		279,567	325,303	

* Revised.

STOCKS IN GREAT BRITAIN

(No. of Tons in Wharves and Warehouses, not including Latex)

At end of	London 1936	1937	1938	Liverpool 1936	1937	1938
January	84,791	29,005	40,203	77,188	41,895	21,711
February	79,757	26,508	46,596	77,138	37,078	24,737
March	74,779	21,292	50,233	72,823	30,622	26,220
April	68,932	21,128	54,296	71,388	27,443	28,277
May	61,349	21,351	57,194	69,150	25,081	29,862
June	55,993	21,964	60,307	66,173	21,258	31,837
July	49,575	22,589	62,236	63,715	19,424	32,825
August	45,749	23,211		62,367	19,817	
September	44,364	28,462		59,485	21,190	
October	40,777	30,465		55,738	21,327	
November	37,495	33,304		51,184	21,399	
December	33,027	35,633		45,291	21,978	

(Figures from the Rubber Trade Association of London)

STOCKS IN OTHER CENTRES

(Figures from Statistical Bulletin of the Int'l Rubber Regulation Committee)

	Penang and Singapore [1]	Malaya [2]	Ceylon [2]	Holland	Para and Manaos
At end of 1937					
August	47,873*	44,775	4,454	144	1,133
September	49,438*	38,131	5,294	135	1,543
October	41,948*	43,900	4,743	117	1,780
November	38,778	45,854	5,378	105	2,901
December	44,792*	45,734	5,632	100	1,771*
At end of 1938					
January	48,494*	49,643	5,976	131	2,024
February	46,241	47,990	5,653	169	2,342
March	50,797	48,473	5,490	180	1,212
April	40,614	45,008	4,812	155	1,083
May	40,598	45,426	4,876	169	816
June	44,729	49,290	4,488	190	924

[1] Dealers' and Port Stocks. [2] Inside Regulated Areas. [3] Dealers' Stocks Only.
* Revised.

RUBBER STOCKS AFLOAT

	Afloat for United States	Afloat for Europe	All Other * Afloat	Total * Afloat
End of: 1937				
June	57,215	34,700	33,085	125,000
July	75,779	45,100	23,121	144,000
August	80,439	40,300	19,261	140,000
September	83,288	37,400	20,312	141,000
October	80,653	35,000	19,347	135,000
November	81,302	39,100	6,598	127,000
December	63,099	45,100	26,801	135,000
End of: 1938				
January	57,356	40,500	15,144	113,000
February	47,459	44,200	16,341	108,000
March	41,882	44,700	22,418	109,000
April	39,071	42,960	31,969	114,000
May	32,879	40,600	20,541	94,000
June	32,079	36,000	21,921	90,000
July	40,400	40,000	21,600	102,000
August	47,772	32,000	20,228	100,000

* *Total Afloat* is an arbitrary estimate based on 1½ months' shipments as adopted by the Department of Commerce. *All Other Afloat* is determined by subtracting the amount of stocks in transit to the United States and Europe from the estimated total.
P— Preliminary estimate.

TOTAL PRINCIPAL WORLD STOCKS

(Figures from the Survey of Current Business)

At end of	1933	1934	1935	1936*	1937	1938
January	634,797	661,948	698,153	600,479	454,249*	551,632*
February	626,227	663,308	686,195	599,355	445,263*	569,242*
March	638,428	666,382	678,809	583,318	447,856*	591,968
April	629,159	658,796	677,006	567,172	428,249*	593,340
May	626,537	689,239	677,569	541,871	413,134*	577,063*
June	613,055	672,804	671,525	520,255	434,250*	581,952
July	618,258	676,200	679,061	519,074	445,782	590,290
August	617,449	674,702	680,644	500,520	457,462*	585,465
September	623,683	694,361	661,509	493,585	470,768*	
October	636,597	680,616	655,000	486,159	479,398*	
November	642,968	684,408	617,300*	466,491	493,266*	
December	654,890	705,975	613,987*	466,576	545,533*	
Monthly Avge.	630,171	677,395	666,397*	528,738	460,022*	

* Revised.

U. S. Tire and Tube Statistics[1]

(All Figures Represent Thousands)

AUTOMOBILE CASINGS

Production Figures on Quarterly Basis — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar.	12,323	11,004	6,635	13,437	13,355	11,798	16,142	7,714
Apr.-June	16,295	12,980	14,412	13,565	12,597	15,443	16,421	8,570
July-Sept.	12,004	9,245	14,707	9,822	11,312	15,467	12,659	
Oct.-Dec.	8,117	6,856	9,550	10,406	12,099	15,409	10,063	
Total	48,739	40,085	45,304	47,230	49,363	58,117	55,285	

Shipment Figures on Quarterly Basis — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar.	11,268	8,760	6,981	10,730	11,154	10,944	14,667	7,716
Apr.-June	15,919	18,021	15,139	14,998	13,473	16,530	16,324	10,745
July-Sept.	14,354	8,141	13,707	11,648	13,489	14,558	13,591	
Oct.-Dec.	8,510	5,329	8,265	9,310	12,066	13,331	10,864	
Total	50,051	40,251	44,092	46,686	50,182	55,363	55,446	

Inventory Figures [2] — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar	10,014	9,878	7,290	11,651	11,675	9,087	12,488	10,808
Apr.-June	10,447	4,999	6,615	10,219	10,755	7,835	12,529	8,763
July-Sept.	8,158	6,096	7,595	8,419	8,288	9,012	11,615	
Oct.-Dec.	7,775	7,644	8,888	9,455	8,196	11,114	10,767	

Figures for Recent Months

	PRODUCTION 1936	1937	1938	SHIPMENTS 1936	1937	1938	INVENTORY [2] 1936	1937	1938
July	5,446	4,292	3,353	5,744	5,190	3,947	7,750	11,654	8,201
Aug.	5,017	3,983		4,977	4,889		7,799	10,813	
Sept.	4,984	4,384		3,837	3,512		9,012	11,615	

AUTOMOBILE INNER TUBES

Production Figures on Quarterly Basis — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar.	11,989	10,721	6,230	12,823	12,553	11,935	15,714	6,938
Apr.-June	15,388	11,913	13,001	13,191	11,631	14,678	15,299	7,177
July-Sept.	12,839	8,286	14,356	10,321	11,270	15,377	11,949	
Oct.-Dec.	8,117	5,970	9,000	9,891	12,425	15,257	9,024	
Total	48,333	36,890	42,587	46,226	47,879	57,247	51,986	

Shipment Figures on Quarterly Basis — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar.	11,251	8,918	6,539	10,640	11,252	11,410	14,498	6,969
Apr.-June	15,314	16,271	13,292	14,553	11,928	15,169	15,381	9,301
July-Sept.	15,282	7,761	13,370	11,545	13,251	15,125	12,805	
Oct.-Dec.	8,174	4,961	8,189	8,306	11,636	12,921	9,693	
Total	50,021	37,911	41,390	45,044	48,067	54,625	52,377	

Inventory Figures [2] — Quarter	1931	1932	1933	1934	1935	1936	1937	1938
Jan.-Mar.	10,475	9,448	6,369	10,244	10,406	8,692	11,904	10,093
Apr.-June	10,504	5,174	6,097	8,795	10,050	8,105	11,746	8,108
July-Sept.	8,095	5,753	7,008	7,639	7,565	8,627	11,242	
Oct.-Dec.	7,922	6,749	7,815	9,180	8,231	10,985	10,235	

Figures for Recent Months

	PRODUCTION 1936	1937	1938	SHIPMENTS 1936	1937	1938	INVENTORY [2] 1936	1937	1938
July	5,177	4,019	2,784	5,758	5,046	3,356	7,725	10,869	7,512
Aug.	5,039	3,885		5,136	4,687		7,621	10,144	
Sept.	5,161	4,044		4,231	3,073		8,627	11,242	

[1] Based on reports received from the Rubber Manufacturers Association.
[2] Held by manufacturers at end of period indicated.

Automobile Production

	United States Total	Passenger Cars	Trucks	Canada Total	Passenger Cars	Trucks	Grand Total
1928	4,357,384	3,826,613	530,771	242,382	196,737	45,645	4,599,944
1929	5,358,420	4,587,400	771,020	263,295	207,498	55,797	5,621,715
1930	3,355,986	2,814,452	540,534	154,192	125,442	28,750	3,510,178
1931	2,389,730	1,973,090	416,640	82,621	63,477	19,144	2,472,351
1932	1,370,678	1,135,493	235,187	60,816	50,718	10,098	1,431,494
1933*	1,920,057	1,573,512	346,545	65,924	53,855	12,069	1,992,126
1934*	2,753,111	2,177,919	575,192	116,852	92,647	24,205	2,869,963
1935*	3,946,934	3,252,244	694,690	172,877	135,562	37,315	4,119,811
1936*	4,454,115	3,669,528	784,587	162,159	128,369	33,790	4,616,274
1937*	4,808,974	3,915,889	893,085	207,000	152,631	54,369	5,015,974
1938							
Jan.*	209,506	155,505	54,001	17,624	13,385	4,239	227,130
Feb.*	186,523	139,380	47,143	16,066	11,753	4,313	202,589
Mar.*	221,796	174,065	47,731	16,802	12,276	4,526	238,598
Apr.	219,314	176,078	43,236	18,819	14,033	4,786	238,133
May	192,068	154,958	37,110	18,115	13,641	4,474	210,183
June	174,667	136,531	38,136	14,732	11,014	3,718	189,399
July	141,437	106,841	34,596	9,007	5,273	3,734	150,444
Aug.	.....	.....	.....	.....	.....	.....	.....
Sept.	.....	.....	.....	.....	.....	.....	.....

* Revised.
Note: U. S. figures represent factory sales; Canadian figures represent production.

Exports of Crude Rubber from Principal Producing Countries

(Long Tons)

	BRITISH MALAYA [1]								DUTCH EAST INDIES [6]						
	Gross Exports	Imports	Gross Exports Minus Imports	Ceylon [2]	India & Burma [3]	Sarawak [4]	British North Borneo [5]	Siam [4]	Java & Madura	Sumatra E. Coast	Other D.E.I.	Indo-China [3]	Amazon Valley	All Other [6]	World Total [7]
1923	252,016	70,432	181,584	39,971	6,416	5,705	4,237	1,718	32,930	46,344	57,822	5,067	16,763	7,856	406,415
1924	259,706	108.524	151,182	39.997	7,697	6,699	4,621	2,962	42.446	54,497	80.347	6,688	23,165	9,065	429,366
1925	316,825	158,022	158,803	49,566	10,082	5,424	5,377	5,377	46,757	65,499	120,626	7,881	25,298	13,797	514,487
1926	391,328	151,243	240,085	58,962	9,874	9,155	9,079	4,027	52,186	71,413	121,231	8,203	24,298	16,017	621,530
1927	371,322	182,845	188.477	55.356	11,321	10,923	6.582	5,472	55,297	77,815	142,171	8,645	28,782	15,633	606,474
1928	409,430	149,787	259,643	57,267	10,790	10,087	6,698	4,813	58,848	82,511	121,770	9,548	21,129	10,690	653,794
1929	574,836	163.092	411,744	81,584	11,663	11,077	7,381	5,018	65,990	87,789	134,037	9,696	21,148	6,767	853,894
1930	547,043	133,876	413,167	76,970	10,782	10,309	6,781	4,251	69,755	79,396	115,254	7,665	14,260	5,651	814,241
1931	519,740	125.506	394.234	61.769	8,470	10,451	6,247	4,218	75,952	87,747	116,009	11,696	12,121	3,292	792,203
1932	478.252	92.539	385.713	48.973	3,888	6.960	4,664	3,451	61,312	79,837	85,871	13,883	6,450	1,816	702,818
1933	573,412	167,377	406.035	63.351	4,527	10,874	7,555	7,765	73.851	91.861	149.659	18.394	9.883	2.737	846.312
1934	677,361	211,803	465,558	79,746	10.492	17.233	11,103	17.345	87,400	112,058	175,470	20,170	8,903	2,985	1,008,663
1935	590,319	174,652	415,667	54,316	13,968	19,465	8.885	28,327	57,488	78,325	139,297	28,816	11,275	8,745	864,574
1936	520,286	167.799	352.487	49,692	14,724	21,243	8,177	33,702	61,307	84,577	152,205	40.782	14,193	11,466	845,431
1937	681,638	213,446	468,192	70,353	17,015	25,922	13,213	35,551	83,978	125,969	208,699	43,387	15,576	12,721	1,120,576
1937:															
Mar.	59,568	19,579	39,989	7,049	2,034	1,425	1,239	3,873	7,856	11,817	19,903	3,160	1,749	872	100,966
Apr.	58,718	17,136	41,582	3,419	1,186	2,960	783	1,899	6,999	8,916	15,944	2,098	1,522	962	88,270
May	51,152	17,350	33,802	4,607	1,007	742	778	2,238	7,530	8,939	20,835	2,888	1,063	1,010	85,439
June	54,809	23,614	31,195	5,149	1,092	1,890	813	2,933	8,269	12,290	24,804	3,673	762	945	93,815
July	71,863	26,100	45,763	6,279	966	2,543	1,414	3,175	7,512	11,557	23,520	5,563	854	1,416	110,562
Aug.	64,525	21,395	43,130	7,308	605	1,624	1,189	2,999	6,785	11,563	21,014	2,277	1,248	1,283	101,025
Sept.	67,414	19,065	48,349	5,804	1,092	2,659	969	3,173	6,402	10,862	19,611	4,131	1,007	1,145	105,204
Oct.	59,319	11,858	47,461	6,701	1,248	523	1,505	2,352	6,587	12,172	14,188	3,753	1,434	1,147	99,071
Nov.	57,850	12,396	45,454	4,391	2,135	2,517	1,327	2,549	6,310	10,003	11,596	4,556	963	1,037	92,838
Dec.	56,791	13,949	42,842	9,529	2,708	3,009	1,172	2,957	9,108	12,272	11,731	5,384	2,011	1,032	103,755
1938:															
Jan.	47,986	17,078	30,908	5,013	1,379	3,485	1,307	2,897	4,476	9,283	12,501	6,086	878	1,400*	79,613
Feb.	48,899	11,874	37,025	5,216	1,423	8	918	3,266	6,391	8,793	12,023	3,068	1,542	1,400*	81,056
Mar.	49,197	15,813	33,384	3,834	1,247	1,564	853	2,837	5,668	10,156	15,284	3,213	1,831	1,200*	80,209
Apr.	53,864	9.158	44,706	1,951	1,347	1,728	1,158	1,583	5,967	10,081	12,274	3,647	1,004	1,200*	86,644
May	38,245	10,325	27,920	2,864	1,283	1,648	815	2,507	4,575	7,515	9,741	3,118	1,053	1,200*	64,239
June	42,258	14,394	27,864	3,705	1,318	2,441	643	3,906	4,519	7,788	11,899	4,773	718	1,200*	70,774
July	43,689	18,713	24,976	3,811	1,103	2,057	937	4,707	6,808	8,271	19,765	5,136	700*	1,200*	79,471
Aug.	47,246	13,735	33,511	4,360	1,000*	1,099	800*	4,564				3,940	700*	1,200*	74,432

(1) Malayan net exports cannot be taken as production, since imported rubber is largely wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included which on a basis of 3½ pounds per gallon amounted to 115 tons in 1923, 1,117 in 1924, 3,618 in 1925, 3,263 in 1926, 2,439 in 1927, 1,437 in 1928, 2,670 in 1929, and 1,274 in 1930. (2) Ceylon Chamber of Commerce statistics until 1926; rubber exported as latex is not included—such shipments were equivalent to 18 tons in 1923, 93 tons in 1924, 6 tons in 1925, 20 tons in 1926, about ½ ton in 1927, and 1 ton in 1928, and practically none in 1929, 1930 and 1931. (3) Official statistics. (4) Imports into Singapore and Penang. (5) Exports from "Other D.E.I." are chiefly wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included which on a basis of 3½ pounds per gallon amounted to 2,342 tons in 1923, 1,008 tons in 1924, 2,239 tons in 1925, 44 tons in 1926, 84 tons in 1927, 1,459 tons in 1928, 1,302 tons in 1929, and 2,656 tons in 1930. (6) Calculated from official import statistics of principal consuming countries, viz., United States, United Kingdom, France, Germany, Belgium and Netherlands, and includes guayule rubber. (7) This total includes the third column for British Malaya, "Gross Exports minus Imports," and all the figures shown for the other territories. * Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE; THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

Net Imports of Crude Rubber into Principal Manufacturing Countries

(Long Tons)

	United States [1]	United Kingdom	France (h)	Germany	Canada (ac)	Japan (da)	Italy	Russia (ce)	Australia (cd)	Belgium (d)	Netherlands	Scandinavia (abcdf)	Spain (g)	Czechoslovakia (abcd)	World Total
1919	238,407	42,671	17,685	5,584	6,395	9,753	9,894	75	1,002	3,995	2,771	3,149	2,418	9	343,808
1920	249,530	56.844	13,885	11,890	11,746	5,297	6,123	62	1,815	3,840	5,510	2,292	2,008	567	371,409
1921	179,736	42.087	15,135	21,920	8,124	21,713	3,906	165	1.014	1,705	1,022	1,279	2,245	569	300,620
1922	296,594	11.724	24,352	27,546	9,207	15,934	6,430	2,493	2,643	172	—3,807	1,778	589	567	396.222
1923	301,527	12.700	27,392	18,519	13,277	15.372	8,489	2,986	1,649	2,184	792	2,528	630	1,128	409,173
1924	319,103	—11.550	30.446	22.727	14,299	19,571	8,764	2,346	3,124	2,688	—807	3,178	944	1,370	416,203
1925	385,596	4.061	32,956	33,937	19,683	11,117	11,412	7,088	4,757	2,930	875	3,149	1,155	1,558	520,274
1926	399,981	84,865	34,240	22,775	20,229	18,125	9,809	6,529	9,021	2,498	2,670	4,046	1,299	1,870	617,957
1927	403,472	60.249	34,271	38,892	26,405	20,521	11,381	12,018	9,490	6,482	636	4,224	2,055	2,672	632,768
1928	407,572	4.846	36,498	37,855	30,447	25,621	12,433	15,134	8,430	7,958	2,243	4,418	3,178	3,138	599,771
1929	528,608	122,675	53,093	49,275	35,453	34,284	17,169	11,774	15,886	9,445	3,022	6,440	864	4,650	894,638
1930	458,036	120,069	68,503	45,488	28,793	33,039	18,639	16,387	5,354	10,635	2,924	7,710	2,400	4,468	822,445
1931	475,993	86.170	46,466	39,688	25,261	43,483	10,149	30,671	7,649	11,009	2,220	6,360	2,605	7,717	794,641
1932	393,844	44,086	42,506	45,121	20,917	56,027	14,469	30,637	12,576	9,519	2,851	7,262	4,359	9,444	693,618
1933	398,365	73,335	61,953	54,120	19,332	66,831	19,341	29,830	13,534	11,166	1,243	7,831	5,520	10,402	772,803
1934	439,172	158,482	49,560	59,330	28,439	69,905	21,398	47,271	9,642	9,115	3,758	12,418	6,900	10,999	926,389
1935	455,758	128,829	51,450	62,899	26,870	57,567	21,880	37,572	9,978	7,593	4,068	11,878	8,140	11,245	895,727
1936	475,359	—2,591	57,032	71,794	27,871	61,223	16,534	30,967	14,109	9,648	2,888	11,236	6,668	8,772	791,510
1937	592,394	92,707	59,871	98,170	36,088	62,311	24,733	28,904	19,164	14,970	4,343	4,680	2,400	13,063	1,063,798
1937:															
Mar.	39,888	343	5,347	7,668	2,612	6,935	2,119	3,598	1,293	1,641	371	709	200*	601	73,325
Apr.	42,066	3,808	5,291	8,664	1,343	5,837	1,669	1,532	1,058	1,069	362	1,070	200*	1,445	75,414
May	48,506	6,100	5,558	6,706	4,187	8,596	2,772	1,886	1,290	2,113	361	1,576	200*	925	90,776
June	48,972	5,157	6,010	6,469	3,791	7,608	1,958	3,940	2,226	1,630	521	1,802	200*	1,150	91,434
July	43,018	10,628	4,306	7,860	1,946	4,851	2,719	2,150	1,902	851	497	1,409	200*	753	83,090
Aug.	49,485	15,757	4,488	8,752	3,506	4,409	2,569	1,226	2,153	1,013	382	1,386	200*	1,692	97,018
Sept.	56,685	15,671	4,820	10,595	2,396	3,666	1,941	1,391	3,184	1,258	337	1,648	200*	1,369	105,161
Oct.	52,926	11,899	4,278	8,076	5,998	2,059	951	2,500*	2,470	967	367	1,535	200*	988	95,214
Nov.	54,135	12,878	4,311	8,848	4,787	1,368	2,857	2,500*	1,935	925	313	970	200*	846	96,873
Dec.	69,660	10,655	5,736	9,580	2,619	1,995	1,976	2,500*	767	1,286	318	1,008	200*	1,890	110,190
1938:															
Jan.	45,596	15,458	4,769	6,314	1,789	4,935	1,857	2,693	574	1,257	300	1,239	200*	1,102	86,083
Feb.	40,977	16,505	5,456	6,959	615	3,173	2,053	2,341	578	974	534	1,114	200*	1,771	82,843
Mar.	42,075	15,911	4,845	10,768	2,123	6,222	1,365	2,162	1,043	961	342	1,088	200*	1,324	90,429
Apr.	31,870	14,653	5,757	6,497	999	5,456	2,397	4,281	640	904	449	971	200*	920	75,994
May	27,809	14,675	5,169	9,595	2,545	3,328	2,422	4,163	1,041	1,137	419	1,283	200*	957	74,743
June	26,429	14,053	4,542	7,460	3,243	4,000*	2,399	4,000*	805	853	663	1,200*	200*	988	70,835
July	22,209	12,678	5,433	6,927					1,215	1,106	526			635	

a—Including gutta percha. b—Including balata. c—Re-exports not deducted in monthly statistics. d—Including some scrap and reclaimed rubber. e—Official statistics of rubber imports by Soviet Russia. f—Including Norway, Sweden, Denmark and Finland. g—United Kingdom and French exports to Spain except in years prior to 1925. h—French imports have been reduced 12 per cent in order to eliminate imports of gutta percha and to reduce to basis of net weight. [1] United States imports of guayule are included in this compilation. * Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE; THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

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